16th

Trostle

PROCEEDINGS

of the 1965 Combined

WESTERN AND CENTRAL FOREST INSECT

WORK CONFERENCE

Denver, Colorado

March 1-4, 1965

Not for Publication

(For information of Conference members only)

Prepared at

Forest Research Laboratory
Canada Department of Forestry
506 West Burnside Road
Victoria, B.C.

GROUP 1 (Upper left)

Row A (L. to R.) B. H. Wilford, Richard A. Goyer, Calvin Kirby, M. E. McKnight, David Baskin, Sidney Weitzman, David Dyer, Tom Silver, Noel Wygant, D. O. Van Denburg

Row B (L. to R.) W. A. Reeks, Carroll Williams, L. H. Moore, Donald N. Kinn, Donald E. Bright, Jr., Paul R. Flink, M. J. Stelzer, F. B. Lewis, J. E. Coster

Row C (L. to R.) John A. Schenk, George R. Struble, Paul Lauterbach, Charles Schaefer, J. B. Thomas, A. H. Rose, Stan Meso, D. A. Hester, Rick Johnsey, Norm Johnson

GROUP 2 (Upper right)

Row A (L. to R.) A. Rudinsky, Dan Dotta, Dean McClanahan, Fred F. Dickison, J. Kinghorn, R. Blomstrom, I. S. Otvos, W. P. Nagel, Dave Donley, C. L. Massey

Row B (L. to R.) W. F. Bailey, Hert C. Cottrell, Oscar H. Schmunk, Carl E. Johnson, David Crosby, R. R. Mason, A. C. Valcarce, D. L. Dahlsten, C. E. Brown

Row C (L. to R.) Edward P. Merkel, W. F. McCambridge, D. A. Pierce, Al Hedlin, Gerry Lanier, H. G. Kinzer, F. M. Yasinski, William E. Miller, Ralph C. Hall, Don Renlund

GROUP 3 (Lower left)

Row A (L. to R.) David O. Scott, Paul A. Grossenbach, Amel E. Landgraf, Ian M. Campbell, Frank E. Webb, Benton Howard, Jim Bean, P. A. Godwin, Kendall Lister, Jack W. Bongberg

Row B (L. to R.) Donn Cahill, Gary Pitman, Thomas Borg, John Simeone, Jim Stewart, Rob Reid, Alan Berryman, John Pierce, Don Schmiege, Galen Trostle

Row C (L. to R.) Scott Tunnock, J. W. Butcher, Donald L. Schuder, W. E. Wallner, M. M. Furniss, John M. Mahoney, Ronald W. Stark, T. O. Thatcher, K. H. Wright, D. E. Gray

GROUP 4 (Lower right)

Row A (L. to R.) C. H. Hoffmann, R. C. Bushland, Royce G. Cox, David L. Wood, Robert I. Gara, Robert P. Harrison

Row B (L. to R.) A. T. Larsen, J. R. Koplin, P. H. Baldwin, C. J. DeMars, W. J. Turnock, M. J. Wrich

PROCEEDINGS
of the 1965 Combined
WESTERN AND CENTRAL FOREST INSECT
WORK CONFERENCE*
Denver, Colorado
March 1-4, 1965.

EXECUTIVE COMMITTEE (Sixteenth Conference)

J.M. Kinghorn, Victoria	- Chairman
K.H. Wright, Portland	- Immediate Past Chairman
A.F. Hedlin, Victoria	- Secretary-Treasurer
R.F. Shepherd, Calgary	- Councilor (1962)
J.A. Schenk, Moscow	- Councilor (1963)
F.M. Yasinski, Albuquerque	- Councilor (1964)

N.D. Wygant, Fort Collins	- Program Chairman

EXECUTIVE COMMITTEE ELECT

J.M. Kinghorn, Victoria	- Chairman
K.H. Wright, Portland	- Immediate Past Chairman
A.F. Hedlin, Victoria	- Secretary-Treasurer
J.A. Schenk, Moscow	- Councilor (1963)
F.M. Yasinski, Albuquerque	- Councilor (1964)
R.E. Stevens, Berkeley	- Councilor (1965)

G.T. Silver, Victoria	- 1966 Program Chairman

---

* Combined meeting of the Western Forest Insect Work Conference (Sixteenth) and Central International Forest Insect and Disease Work Conference. Proceedings prepared by the Secretary-Treasurer, A.F. Hedlin, from summaries submitted. Stenographic services and duplication processing provided by the Forest Research Laboratory, Canada Department of Forestry, Victoria, B.C.

CONTENTS

	Page
Frontispiece	
Minutes of the Initial Business Meeting	1
Keynote Address, Dr. C. H. Hoffman	3
Insecticide - Wildlife - Fish Relationships	5
Economics of Direct Control of Forest Insects	30
Results from and Future Plans for Research on Safer and Less Persistent Insecticides to Replace Chlorinated Hydrocarbons	35
Results of Pilot and Field Tests of Chemicals for Control of Forest Insects in 1964	37
Workshop Summaries	55
Invitational Address, Dr. R. C. Bushland	66
Recent Advances and Future Plans in Forest Insect Control Research	68
Workshop Summaries	85
Minutes of Final Business Meeting	97
Membership Roster	
A. Western Members	100
B. Members from Other Regions	110
Appendix	113

COMBINED MEETING WESTERN FOREST INSECT WORK CONFERENCE, SIXTEENTH ANNUAL, AND CENTRAL INTERNATIONAL FOREST INSECT AND DISEASE WORK CONFERENCE

March 1-4, 1965

The meeting convened in the Denver Hilton Hotel, Denver, Colorado, at 9:00 a.m.

Chairman J.M. Kinghorn opened the meeting by asking the members to stand in a moment of silence in respect of the late C.B. Eaton.

Sidney Weitzman, Chairman C.I.F.I.D.W.C., said a few words to the group on behalf of the members from his group.

E.J. Grambo, Assistant Regional Forester, Region 2, and T.B. Borden, State Forester, Colorado, welcomed the members.

MINUTES OF THE INITIAL BUSINESS MEETING

March 1, 1965

Minutes of the final business meeting of the Fifteenth Annual Western Forest Insect Work Conference at Banff, Alberta, were approved as printed in the Proceedings.

The Treasurer's report was approved as read. The balance on hand as of February 19, 1965, was $241.53.

The meeting approved a suggestion in the Secretary's Report that the Membership Roster be arranged on an alphabetical basis in the Proceedings.

The Secretary-Treasurer outlined the results of the Executive Committee meeting held February 28, 1964. Matters arising from this meeting were:

1. Retired members -- It was decided that recognition should be shown retired or retiring members of the Conference. Chairman Kinghorn asked the group to stand and show appreciation to Ralph Hall.

2. Meeting Places -- It was left to the local group to decide and report at the final business meeting regarding a specific meeting place for the 1967 meeting which will be held in the Ogden - Salt Lake City area.

The invitation to hold the 1968 meeting in Juneau, Alaska, was discussed. Final decision to be made at the final business meeting.

3. Time of Meeting -- The group accepted a recommendation to meet during the latter half of February in 1966. It was suggested that bioclimatology be used as a theme for the 1966 meeting.

4. Combined Meeting -- The group approved a motion by Trostle and Landgraf that our meeting date be moved forward in an attempt to arrange a combined meeting with the pathologists' group.

5. Constitution Committee -- The Chairman appointed A.F. Hedlin (Chairman), A.D. Moore, and B.H. Wilford to arrange wording of the constitution which would allow more freedom in deciding on Registration fees.

6. Nominating Committee -- Ben Howard (Chairman), Cliff Brown, and Ron Stark were appointed to this committee to nominate a councilor to replace R.F. Shepherd.

7. Common Names Committee -- The report of this committee given by George Struble was approved.

8. Translations Committee -- Chairman M. Furniss reported briefly on the findings of this committee. The report will be submitted for inclusion in the Proceedings. It is to be discussed further at the final business meeting.

9. Society of American Foresters -- Stark questioned the group on the feeling regarding a Division of Forest Entomology in this Society. A form questionnaire was provided for distribution.

10. Education Committee -- Chairman Stark - no report.

The meeting adjourned 10:25.

KEYNOTE ADDRESS (Summary)

by

Dr. C.H. Hoffman, Associate Director
Entomology Research Division
Agricultural Research Service
U.S. Department of Agriculture

New Horizons in Insect Control

An integrated approach to insect control -- the use of various techniques in combination -- offers great promise for meeting many of our major insect problems, a U.S. Department of Agriculture scientist said today (March 1) in Denver, Colo.

The objective of this approach is satisfactory insect control along with diminished use of insecticides, Dr. C.H. Hoffman of USDA's Agricultural Research Service said in a keynote address before the 16th Annual Western Forest Insect Work Conference and Central International Forest Insect and Disease Work Conference.

Dr. Hoffman pointed out that about three-fourths of the Entomology Research Division's efforts are now on biological and other nonchemical control measures.

Using chemicals to sterilize insects in their natural environment may prove less costly than laboratory sterilization with radiation, for large-scale eradication programs, if effective and safe ways to apply the chemosterilants can be developed for specific insects. More than 200 chemosterilants have shown some effect on insect reproduction when added to their food supply or applied externally. Among the insects for which chemosterilant control looks promising are the boll weevil, pink bollworm, codling moth, and housefly.

In recent years, scientists have synthesized attractants for the Mediterranean fruit fly, gypsy moth, peach tree borer, cabbage looper, and many others. These attractants have promise for use in drawing the insects into traps or to specific areas where they could be killed with a chemical or some mechanical device.

There is renewed interest in determining the usefulness of light traps in insect control. This interest has been further stimulated by the excellent results obtained in recent experiments with the tobacco hornworm.

The opportunities of discovering and utilizing parasites, predators, and diseases to control major insects in the United States are almost limitless. Outstanding control has already been obtained by using beneficial insects against such pests as the Japanese beetle, gypsy moth, brown-tail moth, European corn borer, spotted alfalfa aphid, and alfalfa weevil. Several insect viruses have shown great promise for controlling such important insects as the alfalfa caterpillar, cabbage looper, bollworm, European spruce sawfly, gypsy moth, pine sawfly, California red scale, and tent caterpillars. It may be possible to produce, package,

and apply insect diseases just as we do with insecticides now.

Crop varieties resistant to insect attack are ideal as control measures, but it usually takes 10 to 25 years to develop suitable varieties for the different regions of the country.

Integrated control -- utilizing various control methods concurrently or successively -- has come to the forefront in recent years. An example is the effective control of the spotted alfalfa aphid. The systemic insecticide demeton killed aphids but did not affect the parasites and predators of this pest. These beneficial insects further reduced the aphids not killed by the systemic and slowed down the buildup of the next generation. In addition, aphid-resistant alfalfas were grown in some areas. By using this integrated control program, it was possible to curtail or even avoid a regular insecticide spray schedule. Another example: on the Pacific island of Rota, the fruit fly population was greatly reduced with a chemical bait spray, after which flies sterilized by radiation were introduced to overwhelm the remaining population.

Summing up, Dr. Hoffman said the future of integrated insect control lies in research to obtain additional information on the biology and ecology of each pest and their interrelationships with natural enemies. We then can relate this information to other insect control practices used for various crops in different parts of the country.

INSECTICIDE - WILDLIFE - FISH RELATIONSHIPS

SETTING THE STAGE

by

Lansing A. Parker, Associate Director
Bureau of Sport Fisheries and Wildlife
Fish and Wildlife Service
U. S. Department of the Interior
Washington, D.C.

Fish and wildlife are a part of the forest eco-system. The kinds of trees and shrubs and how they are managed determine what forms of fauna will occur there. In turn, the animals may affect the composition of the habitat. Thus these relationships must be recognized when planning insect control programs.

Multiple-use policies of most public land management agencies recognize the positive values of fish and wildlife. These include recreational values totaling 650 million days of hunting and fishing in 1960. At that time about 2 out of every 5 persons over 12 years of age engaged in these sports and spent $3.9 billion. Far more people enjoy these resources while hiking, bird watching, photographing or otherwise spending time out of doors. The commercial value to the fishermen for the harvest of fish and shellfish that depend on the estuarine and coastal waters for part or all of their life cycle amounted to approximately $220 million in 1962. This was more than half of the value of the total catch. Biological values, such as the consumption of insects and weed seeds, are well known. Also, there are social and aesthetic values such as the interest in the struggle for survival by the whooping cranes.

Fish and wildlife biologists recognize the need to use chemicals to control noxious weeds and destructive insects. In fact, they use these compounds to control trash fish populations, nuisance birds, and destructive mammals. However, they are concerned when chemical pest control programs are planned and executed without regard for the impact on fish and wildlife.

Studies have shown heavy immediate kills of birds, mammals, and fishes following some insect control programs. Likewise, there have been serious chronic or sublethal effects, such as sudden drastic losses after long periods following application of pesticides, as well as reduced production and survival of young. Also, fish and game may carry loads of chemicals that exceed the tolerances set for similar compounds found in domestic meat.

Several problems have been recognized which are the results of introducing these chemical compounds in the environment. Some have surprisingly long residual life and, even though applied in minimum amounts and at infrequent intervals, they tend to accumulate to levels which are known to be harmful to fish and wildlife. When aerially applied, much and sometimes most of the chemical drifts or vaporizes so that areas far away become contaminated. Only recently Bureau of Sport

Fisheries and Wildlife scientists recovered trace amounts of pesticides in the crabeater seals and Adelie penguins taken in the Antartic. Drastic losses of robins and western grebes pointed up the phenomena called "biological magnification". As the pesticide is passed along from one organism to another in the food chain it becomes more concentrated until the amount is sufficient to kill the predator. (Soil to earthworm to robins in the cases of the Dutch elm disease control on the campus of Michigan State University and at Madison, Wisconsin.) (Water to plankton to fishes to western grebes in the case of gnat control at Clear Lake, California.) Our scientists have also noted the synergistic effects of combining chemicals. Laboratory tests have shown that DDT combined with 2,4-D had a much more lethal effect on mallard ducks than when fed separately.

In May, 1963, the President's Science Advisory Committee issued its report on the use of pesticides. It contained recommendations for the Federal Government agencies concerning all facets of the use of these chemicals. There have been many administrative and legislative actions since then. The Federal Pest Control Review Board was reconstituted under a new charter and is now known as the Federal Committee on Pest Control. It reviews and recommends on the operational control programs which are financed or supervised by Federal agencies. All Federal research, monitoring, and public educational programs are reviewed and coordinated by the committee.

By agreement between the Secretaries of Agriculture, Interior, and Health, Education, and Welfare, the three departments participate in the approval procedure for registering new chemicals and formulations.

In cooperation with a committee of the chemical industry, a testing procedure was developed whereby fish and wildlife species would be used to learn of the effects of new chemicals on these organisms before development had proceeded too far.

In August, 1964, Secretary Udall issued a policy of caution and restriction in the use of pesticide chemicals on Department of the Interior lands. Secretary Freeman adopted a similar policy in December, 1964, and urged that the Department of Agriculture's cooperators adopt the policy too.

The President, in his February 8, 1965, message to the Congress on "Natural Beauty", made several recommendations concerning these chemicals.

In the Congress many committees have held special hearings on the pesticide problem. Legislative action was taken to eliminate the "protest registration procedure" and to require registration numbers on the labels of products registered under the Federal Insecticide, Fungicide, and Rodenticide Act. Also, the Congress, by supplemental appropriation for 1965, added $29 million to the Department of Agriculture's budget for research on pesticides and biological controls. Several new bills have been introduced in the present session of the Congress. One would permit inspection of plants manufacturing the chemicals. Another would give the Fish and Wildlife Service review power over all Federal control programs. Still another would raise the dollar ceiling on the Fish and Wildlife Service authorization to do

research on wildlife-pesticide relations.

Many States and Provinces have established boards or committees to pass on chemical control programs within their borders. They have also outlawed or limited the use of certain chemicals.

All of these actions are constructive and should lessen the dangerous side effects of pesticide programs. However, the user is the one who in the end determines whether control programs will be carried out safely and effectively. Much effort is being put forth by the public agencies to give him sound guidelines.

PESTICIDE-WILDLIFE INVESTIGATIONS IN COOPERATION WITH U. S. FOREST SERVICE

by

Richard E. Pillmore

This was a color-slide presentation outlining the plans of the Denver Wildlife Research Center to conduct field studies of birds and mammals in conjunction with the field testing program of the Insecticide Evaluation Project at the Pacific Southwest Forest and Range Experiment Station; and also sketching the surveillance activities of the Denver Center in conjunction with the forest insect control programs in western United States during the past 5 years. This represents a change from a somewhat extensive surveillance of insect control programs, usually with DDT, touching on problems of residues in game animals to a more intensive study of experimental applications of insecticides made in the search for safer and more selective methods of controlling forest pests.

PROBLEMS IN FIELD EVALUATION OF INSECTICIDE EFFECTS ON WILDLIFE

by

Lowell McEwen, Research Biologist

Abstract

Wild animal populations are by their very nature difficult to study. Ecological interactions are complex and cause-and-effect relationships are difficult to pin down.

When insecticides are applied, exposure of the resident wildlife varies with their activity, food habits, density of vegetation, rate and uniformity of the application and many other factors. In order to iron out the many variables in evaluating effects on wildlife, it is necessary to use statistically adequate sampling systems and sufficiently large study areas. Untreated areas should always be investigated simultaneously in order to detect population changes due to factors other than the insecticide.

Evaluation projects should be designed to fit the type of insecticide used. Organosphosphate applications usually call for short-term, intensive investigations. Chlorinated hydrocarbons call for long-term studies, especially where applications are repeated periodically, because of the persistence of the chemical in the environment and concentration via food chains.

Limitations in funds and manpower make it impossible to evaluate effects of more than a very few of the common insecticides in major habitat types.

FISHERIES PROBLEMS IN FOREST INSECT CONTROL

by

Oliver B. Cope

Abstract

The research program of the Fish-Pesticide Research Laboratory was discussed with respect to geographical locations of the 11 laboratories in which work is done, and with respect to the various types of work under way. The place of forest insect control chemicals in these studies was brought out.

The main features of the work program are: Pest Control Studies, including surveillance of actual operating programs; Toxicant Tolerance Studies, in which bioassay activities reveal comparative toxicities of insecticides to fish and aquatic invertebrates; Physiology and Chronic Effects, in which long-term studies answer questions on what the insecticides do inside the fish, and what the fish do to the insecticides; Field Experimental Studies, in which exposures of insecticides are made in the field under controlled conditions, and the predictions verified or refuted; Selective Breeding Studies, in which fish are given doses of insecticides over a period of time to try to develop resistance; Inactivation of Toxicity, in which means of detoxification through biodegredation and chemical alteration of water are studied; and Methods Research, in which methods of sample handling in the field and of chemical analysis in the laboratory are investigated.

BRIEF REPORTS FROM CONFERENCE MEMBERS

MONITORING CONTROL PROJECTS

by

Benton Howard
Insect and Disease Control Branch
Division of Timber Management
U. S. Forest Service - Region 6

All aerial spray projects are now to be divided into three parts -- entomological, operational, and surveillance -- and they must be in proper perspective. Surveillance is here to stay and is now an integral part of a project.

The administrator must consider the impact of an aerially applied material on the ecosystem. He plans accordingly.

I'll pose some questions and indicate some possible answers.

1. What should be evaluated? Determine the important and critical problems - public health, waters, recreation, game, fish, or other wildlife, food crops -- range cattle, milk, marine crops, etc. In 1962, milk was it in Clatsop County, Oregon; in 1963, oysters at Willapa Bay in Washington; in 1964, game in Montana and salmon in Idaho. In 1965, we will live or die on range cattle. Each project has its own problems and must have its own prescription.

2. How should it be evaluated? To the extent necessary to satisfy the needs. The methodology will vary and change. Past surveillance already indicates what will happen to big game when DDT is used. The animals acquire residues and the residues return to low levels. This is known -- what it means in regard to the public health, I don't know. But maybe we don't need to intensely sample deer or elk populations any longer. "From the standpoint of excessive residues in the adipose tissue, the data indicate that there is no long-term effect in big game animals," (K. C. Walker, et al). But we don't know much about range cattle!

3. Who should say? The Bureau of Sport Fisheries and Wildlife; the State Departments of Game, Agriculture, Sanitary Authorities, etc.; the U.S. Forest Service; State Forestry? In some cases all of them. In any case, the administrator, State, Federal or private, must organize and provide the leadership and the drive.

4. Who should pay? The agencies conducting the project should pay part of the costs. However, the Fish and Game agencies, the Public Health people, the Sanitary Authorities have interests and perhaps should assume a reasonable share.

5. Public relations - a "people" problem. I don't mean I&E work, necessary as it is. The interested and concerned public must be reached. Sometimes it's just one man, sometimes one agency, sometimes local groups, sometimes state groups, and sometimes national groups. Locate your

"public" early. Strive for understanding. Work with them. How? Again each project is different and in each case the "public" may be different. So recognize your problem people and groups and design a program. It is a lot easier to work with people if they understand your problems and needs, even though you may not reach agreement or acceptance.

Lastly - publish!

PROPOSED SURVEILLANCE OF SPRAYING OPERATIONS ON THE 1965 BURNS DOUGLAS-FIR TUSSOCK MOTH CONTROL PROJECT

by

P. W. Orr
Insect and Disease Control Branch
Division of Timber Management
U. S. Forest Service - Region 6

The Douglas-fir tussock moth outbreak we propose to control in Oregon this year has been in progress the last two years. Fifty-five-thousand acres are now infested at five centers near Burns, in central Oregon. Tree killing occurred last year and more is expected unless the larval population is controlled. The infested area is located 25 miles north of the Malheur National Wildlife Refuge, one of the largest in the United States. Deer, elk, and small game use the area. About 9,000 range cattle graze on parts of the infested area. Plans call for using 3/4-pound DDT in one gallon No. 2 fuel oil, per acre, to be applied by helicopter for greater spray pattern control.

Because of increased public interest in use of insecticides a surveillance committee was established to closely follow all phases of this control job.

Surveillance of spray operations to determine spray-caused damage to other than the target insect has been done to a limited extent on past control projects in the Pacific Northwest. In most cases these efforts were less than ideal. Methods and procedures developed on the 1963 Willapa Bay western hemlock looper control project established the precedent for surveillance of future large-scale forest defoliator control operations.

Planning for the 1965 surveillance program is underway. Preliminary meetings with interested agencies were held November 10 and January 20 to consider the need for surveillance and solicit cooperators in the surveillance effort. About 25 people attended these meetings. Mr. Ed Marshall, Assistant Regional Forester, is chairman of this committee, and the actual surveillance efforts are being headed up by Dr. Glenn Crouch, a range conservationist on the Mt. Hood National Forest. Small work group meetings are scheduled to form definite work plans, commit personnel and set standards for data collection.

We expect that teams from the various public health, wildlife, livestock, and land managing agencies and universities will sample game animals, birds, fish, and elements in their environment before, during, and after spraying to determine insecticide residues. This will be the short-term goal. Several long-range studies will follow the fate of the insecticide residues in the environment.

The groups taking part in the surveillance program, and the work they will do, is as follows:

1. U. S. Forest Service

NFA - Coordination of the surveillance program. Divisions of Timber Management and Range and Wildlife Management will check residues in cattle, and assist cooperators in collecting samples. Provide some financial assistance to cooperators.

PNW - Division of Watershed Management Research is planning a long-term study of the fate of insecticides in soils. Included in this will be: Distribution of DDT immediately after aerial application; fate of DDT at various times after aerial application; and, effect of DDT residues on micro-organisms.

2. Bureau of Sport Fisheries and Wildlife

Residues in selected wildlife species on and near the Malheur National Wildlife Refuge. Some work will probably be done on birds within the spray area and on Malheur National Wildlife Refuge.

3. Agricultural Research Service, Entomology Research Division, Analytical Chemistry Investigations, Yakima, Washington

Laboratory analysis for DDT residues in animal and plant tissue. There may be some analysis of some fish and water samples collected by others.

4. Oregon State Game Commission

Plans are being made to check DDT residues in deer, elk, fish, aquatic insects, and vegetation.

5. Oregon State University, Department of Fisheries and Wildlife

Surveillance of residues in fish, small mammals, and birds. A long-term research project may be undertaken.

6. Other cooperators who will assist when possible and act as consultants:

Malheur National Forest - Manpower and, of course, the insects.

U.S. Public Health Service - May analyze water samples.

Oregon State Sanitary Authority - May be able to analyze water samples.

Oregon State Department of Forestry - Observation, liaison, and possible manpower.

Oregon State University, Dept. Agr. Chemistry, Animal Science and Veterinary Medicine - Advice, and some analysis of pesticide residue in tissues.

As we see it now the problems on this job, somewhat in order of their magnitude, are insecticide residues in:

(1) Beef cattle
(2) Big game summer range
(3) Waterfowl (migratory, fisheaters)
(4) Fish (sports and commercial)
(5) Domestic water supply

ECONOMIC EVALUATION OF RESOURCES FOR THE PROPOSED 1965 DOUGLAS-FIR TUSSOCK MOTH CONTROL PROJECT, BURNS, OREGON

by

P. W. Orr
Insect and Disease Control Branch
Division of Timber Management
U. S. Forest Service - Region 6

I. Introduction

A. First reported in 1963 on Malheur and Ochoco National Forests, 1,000 acres and building up.

B. Aerial survey, 1964 - 55,000 acres.

C. About 16,000 acres - moderate to heavily infested, tree killing in progress. Much more likely this year.

Area	Total acres infested	Acres by degree of defoliation			
		Light	Moderate	Heavy	Very heavy
Antelope Mountain	14,840	10,200	880	2,320	1,440
King Mountain	18,690	10,040	2,800	3,760	2,090
Gold Hill	6,250	3,600	2,480	170	0
Silver Springs	1,110	1,110	0	0	0
Vance Creek	380	380	0	0	0
Total	41,270	25,330	6,160	6,250	3,530

Areas and acres proposed for spraying during 1965 - Malheur and Ochoco National Forests:

Proposed spray unit	Acres
Antelope Mountain	18,060
King Mountain	24,160
Gold Hill	8,850
Silver Springs	3,600
Vance Creek	610
	55,280 @ $2.60 per acre = $143,728.00

RESOURCES

II. People and Industry

A. Population in immediate area.

1. About 5,000 people live in the Burns area.

2. 85 percent of working force in Burns and Hines, Oregon, work at one mill (about 800-1,000).

B. Industry.

1. One mill - at Hines, Oregon.

2. Requirements - 100 MM bd. ft. ponderosa pine annually.

   a. The Government supplies 96 percent of this volume.

3. Needs will increase because mill has recently constructed:

   a. New stud plant (installation and operation predicated on availability of true fir and Douglas-fir timber).

   b. New peeler plant.

4. This new need will be white fir and associated species.

   a. 30-40 MM bd. ft. annually.

5. White fir - about 8-1/4 percent of total inventory volume in the area.

6. Associated species - about 11-3/4 percent of the total inventory volume.

7. Ponderosa pine - about 80 percent of the total volume in area.

III. Timber Resource Threatened by the Douglas-fir Tussock Moth Outbreak

A. Immature Timber.

	Acres	Value	
1. Already killed, defoliated over 50 percent in 1964 (@ $105/acre)	1,950	$ 204,700	$3,700,000
2. Immediately threatened (@ $105/acre)	33,700	$ 3,538,500	
3. Ultimately threatened (@ $105/acre)	122,000	$12,810,000	

B. Merchantable timber.

	Volume M bd.ft.	Value
1. Already killed	2,610	$ 15,100
2. Immediately threatened	262,580	$1,024,000
3. Ultimately threatened	950,000	$3,705,000

Estimates of tussock moth damage to the timber resources were developed from sample plots within the Antelope Mountain infestation area. Forest specialists in timber inventory activities designed a sampling procedure for measuring tussock moth damage to immature and merchantable trees. Actual plot measurements taken in the field during November, 1964, were applied to known infestation areas where damage was considered to be 50 percent or greater. Immature timber values are based on Malheur Forest 3-year average costs for planting plus protection of planted areas. Merchantable timber values are based on average appraised values experienced on the Malheur National Forest during three quarters of calendar year 1964 and one quarter during calendar year 1963.

IV. Wildlife Resource

A. Big game.

1. Summer resident mule deer
   a. Estimated numbers - 1,025
   b. Estimated man-days hunters use - 1,650 @ $4.50/day = $7,425
   c. Estimated annual harvest - 210

2. Summer resident elk
   a. Estimated numbers - 75
   b. Estimated man-days hunter use - 300 @ $6.00/day = $1,800
   c. Estimated annual harvest - 25

B. Other species present.

Unit	Species - No.	Species - No.
1. King Mountain	Grouse - few	Beaver
2. Antelope Mtn.	Grouse - few	Beaver
3. Silver Springs	Grouse - few	Rabbits - scattered
4. Gold Hill	Beaver - few	
5. Vance Creek	Grouse - few	

C. Fishery resources.

1. Native trout

Unit	Key streams	Angler use
King Mountain	Rattlesnake Creek	Moderate - Success good
	Coffeepot Creek	Moderate - Success good
	Trout Creek	Moderate - Success good
	Pine Creek	Moderate - Success good
	West Fork Pine	Moderate - Success good

Unit	Key streams	Angler use
Antelope Mtn.	Bluebucket Creek	Minimum - Success excellent
	Cottonwood Creek	Minimum - Success excellent
	Cliff Creek	Minimum - Success excellent
	Buttermilk Creek	Minimum - Success excellent
	Cougar Creek	Minimum - Success excellent
Gold Hill	Gold Creek	Minimum - Success fair
	Myrtle Creek	Minimum - Success fair
Silver Springs	Silver Creek	Minimum - Success fair
	Allison Creek	Minimum - Success fair
Vance Creek	Vance Creek	Heavy - Success good
	Canyon Creek	Heavy - Success good

2. Anadromous fish

Vance-Canyon Creek drainage is an important steelhead spawning area. State recently planted 350,000 Coho salmon eggs in Canyon Creek where they have installed an incubation channel downstream from the spray area.

V. Recreation

There are no improved campgrounds or picnic areas in the project area. Hunters and fishermen use unimproved camp areas for camping in tents, trailers and pickup campers, particularly during deer and elk hunting season.

VI. Water

Canyon Creek is the largest stream in the project area. It is used only incidentally as a source of domestic water. The towns of Burns and Canyon Creek utilize wells and springs for domestic water supplies. The source of many small streams is found in the high country where the control project is located. Most of these streams become intermittent after the snow pack is melted. Man-made water ponds and natural springs are utilized by range cattle. Stream water is utilized to irrigate fields in the valley areas during the dry summer season. These fields are usually several miles removed from the project area. There are no lakes within or adjacent to the control boundaries. To protect these resource values we propose to spray the 52,280-acre infestation at an estimated cost of $2.60 per acre or $143,700.00.

PESTICIDE RESIDUE STUDIES IN FORESTED AREAS IN WISCONSIN

by

Donald W. Renlund, Supervisor
Forest Pest Survey and Control

Records of pesticide use on forested areas in Wisconsin indicate that the first aerial application was made in 1926 when calcium arsenate was used in an attempt to control the hemlock looper. From then until 1945, when DDT was first used in the state, records of other treatments are sketchy. In subsequent years, however, increasingly accurate records have been kept of chemicals, rates of application, and land descriptions treated. These records show that DDT, at the rate of one pound per acre, has been the principal compound used in combatting defoliators and spittlebugs whenever an insecticide was required.

While insecticides have been applied to parcels of timber varying from a few acres to several thousands of acres annually during the past twenty years, they have not been the sole source of control of forest insect problems. Natural control factors and silvicultural practices have also played an important part, and have controlled outbreaks on far more acreage than has been treated with chemicals. Yet, they have not been effective enough at times, and have had to be supplemented by chemical applications.

Chemical control and its over-all effects on the biota have been closely scrutinized in Wisconsin by entomologists, and specialists in other biological fields representing many agencies. Cooperation between these agencies, which have the common objective of promoting the safest possible use of chemicals on our forests has been very gratifying.

To date no serious apparent detrimental effects have been encountered. This may, in part, be due to stringent control of applications from the ground and from the air, and to the skillful and conscientious work of pilots who have applied the chemicals.

In the fall of 1961, the staff of the Pesticide Residue Laboratory of the Wisconsin Department of Agriculture became interested in the evaluation of residues in previously treated forest areas, and comparing them with similar areas having no known history of treatment, and with some located in vicinities of agricultural lands.

Pre- and post-spray samples of tree foliage, ground flora, duff, and soil were collected in evaluating a pine tussock moth control operation conducted in June, 1962. Fat samples were collected from deer and porcupines in the fall of that year from the treated area and elsewhere in the state. Similar sampling has continued annually and kinds of samples have been expanded to include water, bottom samples, and flora and fauna from certain lakes and streams.

The 1964 pine tussock moth control program was approved by the Conservation Commission contingent on the establishment of an acceptable biological evaluation program. Game research specialists designed a small animal trapping program which netted 260 specimens ranging from the pygmy

shrew to snowshoe hares and a few birds. In addition, a study of the effects of ingesting treated larvae by day-old chicks was conducted in cooperation with the university. Samples from deer totalled 109 by the fall of 1964, and more than 625 samples have been taken altogether.

Early analyses were made with a Beckman DK2A recording spectrophotometer, and after March 30, 1964, a new Jerrell-Ash, Model 28-710 gas chromatograph has been used. Results obtained with one technique have been verified by one or more other techniques when they have been questionable.

So far it appears that there is no cause for alarm, even in areas where chemical applications have been heaviest, but these investigations will continue. While it is recognized that they provide us with a superficial look at pesticide residues on the landscape, and interpretation of results is difficult, they do provide background data which should be useful in evaluating later changes in the residue picture.

Future sampling will be limited to the availability of accommodations for running analyses, and to types which may provide the most useful information. It is hoped that more sophisticated studies will be attempted in Wisconsin.

We are indebted to the Wisconsin Department of Agriculture for their voluntary and generous contribution in collecting and analyzing samples, and to many others who participated in getting this work started in the State.

WASHINGTON STATE POLLUTION CONTROL COMMISSION
HEMLOCK LOOPER STATEMENT

by

Charles Ziobell, biologist and
Alfred T. Neale, Chairman
(Read by Norman E. Johnson)

A systematic study of environmental influence was conducted in conjunction with the 1963 Hemlock Looper Control Project which involved more than 70,000 acres of mature hemlock stands in the Willapa Hills area of Western Washington.

This study was referenced to fresh water streams, the terrestrial environs and the marine waters of Willapa Bay. Water and other resources considered included fishery, shellfishery, big game and agriculture and domestic water supplies.

The staff of the Pollution Control Commission served as the study project coordinating agency and also as an active participant in the chemical and fresh water biological phases of the study.

Procedures followed in activating the study program included notification of all state and federal agencies and private industry of the need for advice and assistance in planning and carrying out the study program. Four pre-spray meetings and one post spray meeting was held to discuss the nature and scope of the study problem, to discuss and review study plans and to develop a post spray study program. Representatives of 29 agencies involving more than 70 personnel voluntarily contributed their services in this continuing study.

The procedures followed included a determination of the water uses and resource values to be considered, agreement on spray application techniques to be followed to prevent and minimize environmental conflicts. Specific study areas and study streams were then selected and monitoring plans developed.

Study plans were referenced to chemical and biological monitoring in 5 fresh water streams and in selected marine and terrestrial areas. Provision was made for the collection of background chemical and biological data well in advance of the spray project, for intensified monitoring during spraying and for follow-up studies of decreasing intensity as the environment returned to normal or pre-spray conditions.

The study indicated that interagency liaison and coordination in these matters is both practical and feasible and that much can be done to minimize side effects in the environs of a spray area.

A status report of the study was completed during the summer of 1964 and a completed report is in process of preparation and scheduled for early publication.

In summary it can be said that:

(1) No fish were killed by the spray. There was no killing of fish, crayfish or caddis larvae in live boxes, nor were any taken in drift nets or fish traps set in the stream.

(2) DDT levels increased from .01 ppm to 1.07 ppm in a stream receiving up to 600 parts per trillion DDT. In the stream draining the largest sprayed area, DDT levels increased from .02 ppm pre-spray to 0.55 post-spray. After 1 year the level was 0.31 ppm.

(3) Early instar mayflies were killed in two streams receiving 200+ parts per trillion DDT.

(4) Number of fly counts were back to normal by the end of the season.

(5) No differences, attributable to DDT, were detected in fish or insect counts in the four treated and untreated streams in 1964 - one year after spraying.

EFFECTS OF DDT AND MALATHION ON FOREST ARTHROPODS

by

Donald L. Dahlsten

This investigation was initiated as a result of a chemical control project for the white fir sawfly, a species in the Neodiprion abietis complex. Approximately 2880 acres were sprayed with 3/4 pound of DDT in one gallon of diesel oil per acre and 320 acres were treated with one pound of Malathion in one gallon of diesel oil per acre. The study areas are located in the northeast corner of California in Modoc County at Knox Mountain which is 25 miles southwest of Alturas. The work was done with the cooperation of the California Division of Forestry, the regional office of the U. S. Forest Service, the U. S. Fisheries and Wildlife Service and private industry.

The overall objectives are to evaluate the impact of these chemicals on the insect fauna of a forest community. Long-term population studies of the white-fir sawfly and the Douglas-fir tussock moth have been initiated in the study area. The parasite complexes of these species are being studied in several areas and the impact of the chemical insecticides on the parasites of these defoliators will be evaluated both quantitatively and qualitatively. In addition, some idea of the insect fauna in the area will be obtained from the drop cloth samples. It is hoped that explanations for such problems as resurgence of defoliator populations or new arthropod problems in the region will be made available through such a sampling program. Other detrimental effects on the arthropod component of the forest community will also be documented.

Four study areas were established: one in the area sprayed with DDT, one in the area sprayed with Malathion, and two areas were set up as check areas. Thirty sawfly egg clutches were marked and the total eggs counted prior to the spray date in each of the four areas. Each colony or clutch was counted twice a week after eclosion commenced. The counts were continued until all the larvae were killed or until the larvae moved from the study branch or until the larvae dropped to the ground to spin their cocoons. These data are not summarized but when they are the mortality rates of sawfly larvae in the unsprayed areas will be compared to the sprayed areas. Data on natural egg mortality will also be available.

Drop cloths were set up under white-fir trees in each of the study areas. Six drop cloths were set up for each treatment. Four additional drop cloths were set up in the DDT area to collect residue samples for the U. S. Fish and Wildlife Service at Davis. These cloths were adjacent to four of the drop cloths in the DDT area. The cloths were suspended three feet from the ground on 2" x 2" wood stakes. A rock was placed in the center of the cloth to keep the wind from blowing the specimens from the cloth. Collections were made at intervals of four hours, 12 hours, one day, two days, one month and two months after the spray was applied. Each of the check cloths were collected daily because of drift. Drift was detected by placing four oil sensitive cards in the open areas around each drop cloth.

Differences were noted between the effects of DDT and Malathion on sawflies as well as other insects. The total number of sawfly larvae collected from each area was calculated and the percentage taken at a given collection interval was recorded. In the Malathion area, 65 percent of the total number of larvae killed were collected four hours after spray and almost 97 percent one day after spray. In the DDT area, 35 percent of the larvae were collected four hours after spray, 85 percent one day after, and 90 percent two days after. The immediate effect of Malathion was also observed on other insects.

Overall, 12 orders of insects were collected from the drop cloths in addition to a number of spiders and some mites. Results are far from complete as many of the groups are still out to the various taxonomic specialists. As might be expected, large numbers of Diptera and Hymenoptera were collected, in Diptera alone, 32 families are represented in the collections. Another common insect in the drop cloths from both study areas was a thrips, Leptothrips mali. This may prove to be a particularly detrimental effect of these chemicals as this insect is a predator of phytophagous species of thrips, aphid eggs and mites. Other preliminary conclusions that might be drawn are that DDT appears to be more harmful to collembolans than Malathion and that Malathion is more harmful to brown lacewings than DDT. Another trend has been noted in summarizing the data for Diptera, that being that large numbers were collected up to one week after spraying in the DDT area while large numbers were collected in the Malathion area up to two weeks after spraying.

SIDE EFFECTS OF JAPANESE BEETLE AND CEREAL LEAF BEETLE

by

J. W. Butcher
Department of Entomology
Michigan State University

Suppression Programs in Michigan

The scope of side effects studies in Michigan is as follows:

1. Curtailed aquatic and terrestrial arthropod studies were carried out in 1964 to ascertain the persistent effects of Aldrin and Dieldrin applied in 1959-1962 for Japanese Beetle control.

2. Monthly milk samples are being taken for the purpose of measuring Dieldrin residues in milk from herds within the treatment zone. Stream and well water, soil, animal and plant food were also collected at appropriate intervals for analysis.

3. Pre- and post-control observations were carried out on spray drift; and indicator arthropod abundance as related to applications of Sevin and malathion for cereal leaf beetle control in the spring of 1964. Terrestrial and aquatic habitats were sampled.

4. An intensive study was initiated on the persistent effects of dieldrin applied for Japanese beetle control in 1962. Randomized and replicated soil cores were taken from woodlots inside and outside of the treatment zones. The abundance of 12 Collembola species and mite populations were related to actual dieldrin residues present in the soil at each collection point.

5. A controlled application of malathion at rates recommended for cereal leaf beetle control was made in a representative water course in Berrien County. The pattern of arthropod dislodgement and depletion with respect to time and the total aquatic arthropod species complex was compared between treated and check plots.

6. Pre- and post-treatment soil and water residue samples were collected and analyzed in Calhoun County, where hand applications of dieldrin were made for Japanese beetle control in the fall of 1963 and the spring of 1964.

APPROACHES TO DUTCH ELM DISEASE CONTROL

by

J. W. Butcher
Department of Entomology
Michigan State University
East Lansing, Michigan

Currently, research at Michigan State University on Dutch elm disease vector control centers around:

1. Seasonal development of Scolytus multistriatus and Hylurgopinus rufipes.

2. Distribution and concentration of DDT and methoxychlor residues in bark, soil and water courses.

3. Relative efficiency of DDT and methoxychlor in vector control.

4. Development of a laboratory screening procedure for systemic insecticides by means of bark beetle bio-assay.

5. Cooperation with U.S.F.S. in a regional Bidrin tree injection experiment.

A COOPERATIVE PROGRAM WITH BUREAU OF COMMERCIAL FISHERIES

by

D. C. Schmiege

The Northern Forest Experiment Station, U. S. Forest Service, Juneau, Alaska, and the Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, are interested in controlling forest insect pests by means that are not harmful to fish. A cooperative program has been planned to work jointly on promising methods of biological control. The initial work will explore the possibilities that seem most promising. Introduced parasites for use against two species of defoliating insects are now being considered.

SCHEDULING WHITE PINE WEEVIL CONTROL

by

J. L. Bean
Regional Entomologist
U. S. Forest Service
Upper Darby, Pa.

We are all well aware that timber production can be substantially increased by controlling certain forest insects. We also know that control methods are becoming even more effective and less costly.

But, timber production is a highly competitive business today, and one in which the margin of profit can be very narrow. Therefore, any factor that may influence the margin of profit is of concern to the forest manager.

In the Northeast the question of profitability is a major question for the timber producer especially where plantations are involved. It is in relation to white pine plantations that I wish to confine my remarks here today.

One of the major factors that influences profitability in managing white pine plantations is the white pine weevil. For the sake of brevity I will assume you are all well acquainted with the white pine weevil and the damage it causes.

Although controlling the weevil has plagued pine managers for a number of years, studies by Crosby, Waters, and others have shown that weevil control is possible under certain conditions and is also justified. But the big question has always been - can we do the job and still make a profit?

Recently, procedures have been provided that permit economic and biological information to be integrated when deciding upon the need for control against the weevil, and for scheduling its application in young white pine plantations. Most of you, I believe, are acquainted with the publication by Marty and Mott which outlines these procedures (Evaluation and Scheduling White Pine Weevil Control in the Northeast-Research Paper NE-19).

In 1964 the Branch of Forest Pest Control in Region Seven field tested these procedures to determine their accuracy and applicability throughout the Region. An analysis of our field data has just been completed.

The results show that evaluating and scheduling weevil control based on Marty's and Mott's guidelines is possible in New England, New York and Pennsylvania, but is not in Virginia, New Jersey, and West Virginia. The reason being that weevil infestations proceed more rapidly than in the area from which the table data were originally obtained. We also found it possible to predict the profitability of weevil control throughout the areas where the guides were applicable.

As a result of our tests we are now revising our present weevil control guidelines and will be using the M. & M. approach in our future weevil control programs. Also, since the M. & M. method is restricted to pine plantations and to a specific area only we are planning additional field studies to develop similar guides for natural pine stands and other pine producing areas in our region. These studies will be initiated this coming season.

ECONOMICS OF DIRECT CONTROL OF FOREST INSECTS

Chairman: F. E. Webb

CONTROL OF THE WHITE-FIR SAWFLY AND DOUGLAS-FIR TUSSOCK MOTH IN CALIFORNIA

by

R. C. Hall

Late in June, 1965, a cooperative control project was carried on against the white-fir sawfly on 3,200 acres of white fir, under intensive Christmas tree management in Modoc County in California. Two insecticides were used. DDT was aerially applied at the rate of 3/4 pound in one gallon of diesel oil per acre on 2,880 acres and malathion at the rate of one pound in one gallon per acre on 320 acres. Although the primary target insect was the sawfly, there also existed some local areas of high outbreak by the Douglas-fir tussock moth. The spray was applied just after the sawfly eggs had hatched and about the time of the first hatching of the tussock moth eggs.

Pre-spray counts of 3,754 living sawfly larvae were made the day preceding the DDT spray application. The post-spray count ten days later showed only 44 living, or a kill of 98.8 percent. Similar counts of 1,689 living larvae were made on the Malathion area the day before spraying. The post-control count ten days later showed no living larvae or a kill of 100 percent.

The effect of the DDT spray on the tussock moth was quite striking. In a sampling of egg masses in October following the spray, not a single egg mass was found on the sprayed area, as well as practically no evidence of feeding. Malathion, on the other hand had no measurable effect on the tussock moth. Medium levels of egg masses were found on the Malathion treated area coupled with average heavy defoliation. In the check area surrounding the DDT treated area medium levels of egg masses were found as well as heavy defoliation.

The economics of the control project includes some of the following data. The average cost of the DDT control project was $1.29 per acre, and for the Malathion was $2.20 per acre. The year preceding the control project, an attempt was made by one of the private owners to harvest some of the Christmas trees, with the result that 40 percent proved to be unsalable when they reached the market and it was necessary to make a refund to the purchaser. The other private owner was unable to find any bidder for offerings because of the thin foliage. There was remarkable recovery of the sawfly defoliated trees the season of the spraying, and one of the operators harvested his normal complement and the other was able to sell about $10,000.00 worth of stumpage. Therefore, the two private land owners were able to recover more than the cost of the control project the first year after treatment.

THE ECONOMICS OF DIRECT CONTROL OF BARK BEETLES

by

K. H. Wright

Opening

I am not a logical one to discuss this topic, because we have done very little direct control of bark beetles in the Pacific Northwest. I believe all the other regions in the West have done more than we have. However, this is not to say that we haven't had or will have many bark beetle problems, nor that we don't have to make control decisions. Some of our past and probably future problems concerning direct control of bark beetles are:

Western pine beetle in ponderosa pine - sanitation salvage methods have provided an effective tool. Some early-day fell-peel-burn control was employed.

Douglas-fir beetle - Except occasionally in very high-use areas such as campgrounds, where direct control with chemicals was employed, the recommended control has been salvage of infested trees.

Mountain pine beetle - In western white and sugar pines no direct control has been recommended, mainly because the problem is complicated with blister rust. In lodgepole, considerable direct control was employed about 35 years ago in Crater Lake Park. More recently, in the early 1950's, some control was attempted by logging infested trees. In ponderosa pine pole stands, where the problem is an increasing one, we have done some treating of standing trees with ethylene dibromide and just this winter an administrative study using the cut-pile-burn method was used.

In the short time allotted to me it would be impossible to discuss in depth the economics of direct control of bark beetles. Instead of attempting to do so, I would like to discuss, as an example, the economics of one bark beetle problem in our region -- the mountain pine beetle in lodgepole pine.

To help orient the talk, I will show this kodachrome slide which demonstrates heavy tree-killing by the mountain pine beetles in lodgepole pine stands in central Oregon. The outbreak shown here occurred in the early 1950's, and has since subsided. The only control action taken in this instance was to make some timber sales of infested trees. However, the operator found that the undertaking was not economical and only a small area was logged.

Perhaps the main reason I chose this subject for discussion is that we (at least I) anticipate that we will be faced with a major epidemic with this insect in this host species before many years. History tells us this is the case. At last inventory we had, in Oregon and Washington, stands comprising about 9 billion board feet of lodgepole pine sawtimber type on some 2.3 million acres. There is an additional large volume of this species in mixed forest types.

Much of the lodgepole is mature or overmature. We know from long experience that when extensive stands of the species reach this condition, the situation is ripe for a major mountain pine beetle outbreak. Typically, the beetle kills essentially all the large trees over extensive areas, the outbreak subsides, and things are quiet for about another 30 years when the smaller, less susceptible understory trees have grown to maturity and become susceptible.

Now, let us assume that a major part of the 2-1/2 million acres of lodgepole forest I mentioned a bit ago becomes infested in the next 5 years--and this could conceivably happen, in my opinion. Immediately, the question would be asked--should we attempt control. Consequently we would be involved in the subject assigned to me for discussion here--the economics of direct control of bark beetles; in this case the mountain pine beetle.

I think in evaluating the economics of control of any forest insect outbreak there are a number of key questions to be asked and answered. Let's ask some of these questions about the not-so-hypothetical situation before us, and attempt to answer them.

1. What is the value of the resource? Timber values of lodgepole in our region are low, and very little lodgepole is cut because there is very little demand. In 1964 it amounted to less than 1% of the timber cut in the pine subregion; average stumpage price on Forest Service lands was $3.69 per thousand board feet. Several attempts to utilize the species profitably on a significant scale have failed. It is estimated that, on a sustained yield basis, 50 times as much lodgepole could be cut in Oregon and Washington as is now being cut.

   In some areas, aesthetic and watershed values of lodgepole are high; in most they are not.

   However, perhaps our main concern should be the future values. No doubt they will increase--but how much?

2. What would be the cost of control? I understand costs for chemical control of the mountain pine beetle in lodgepole in the Rocky Mountain area are running about $4.00 per tree. Presumably, costs in our region would be similar. In a very large infestation, which typifies many, if not most, mountain pine beetle outbreaks in lodgepole pine, hundreds of thousands of dollars, and probably several million would be needed to carry out a meaningful control program.

3. What are the short and long-term losses? In the short term view, "loss" in terms of tree-killing of merchantable trees can be almost 100 percent over extensive areas. However, in the long-term picture this should perhaps not be termed "loss" because, typically, the understory small trees are not killed--i.e. in about 30 years a merchantable size forest has regrown. Perhaps by then lodgepole will have significant value. In those areas where true-fir species grow in mixture with the lodgepole, a true-fir stand would likely replace the lodgepole. This would perhaps be for the better because true-fir is a much more valuable species for lumber and fiber than lodgepole.

4. Is the outbreak too large to control--physically and financially. This could be a very appropriate question in regard to the problem under discussion. As mentioned, these outbreaks often, if not usually, cover very large areas. The tremendous outbreaks now in progress in the Rockies are typical. Further, the lodgepole type may be contiguous for miles--so there is no logical breaking off point if money and manpower are available to do only part of the job. To conclude on this point, I strongly suspect that the outbreak would be too large to undertake rapidly enough, with the resources available, to exert effective control by treating individual infested trees.

5. Will control action have a lasting effect? This is probably a debatable point, but, in my view, control probably would not be lasting because the most important contributing cause to the epidemic is the susceptible-age condition of the stand. Unless the stand conditions were altered, the threat of outbreak would be ever-present. In some instances, however, control may be justified on the basis of "buying time"--if harvesting of the forest is scheduled in the near future.

There are a great many more questions relating to economics that could be discussed--and most of them would pertain to any bark beetle control program under consideration. Some of them are:

1. Will soil erosion or related damage result if control isn't accomplished?

2. Does the land-ownerships pattern lend itself to practical control?

3. Could the control dollars be better spent on other forest improvements?

4. Will a dangerous fire problem occur if the epidemic isn't controlled?

5. What will be the impact on public relations if control is not attempted? Or if it is attempted--but is not successful?

We should consider an over-riding question that is perhaps more biological than economic; however, I submit that it can't be omitted from economic evaluation. The question is "Can the outbreak be controlled?" If there is a strong element of doubt that it can, certainly the economic considerations are vitally affected. In the situation under discussion, I would not want to be the entomologist who stuck his neck out and said that presently known control methods had even a strong chance of success.

So, in conclusion, I submit that economic evaluation of bark beetle control is very difficult, complex, and the chances considerable that the conclusions reached will be in error. However, it is still vitally important that the best possible economic evaluation be made to answer the key question:

> Even though we have a lot of beetles in the woods and many trees dying can we justify the cost?

Concerning the potential Oregon-Washington problem I have laid before you, I know those of us here from Portland concerned with both Research and Control will welcome your counsel. Perhaps in the discussion period, someone will tell us what we should do.

A FEW HOURS IN THE LABORATORY CAN SAVE THOUSANDS OF DOLLARS IN THE FIELD

by

Norman E. Johnson

After the horse is out it is easy to look back and see where the fence should have been strengthened. The story we tell here is only of use in future planning.

When the Federal Pest Control Review Board ruled that no federal agency could participate in the 1963 Willapa Hemlock Project if DDT were used on areas draining into the oyster producing bay, a decision had to be made in a hurry to select an alternative pesticide.

Two untried pesticides and DDT were chosen for pre-project tests. Phosphamidon had been tested in Canadian laboratories and showed some promise. Carbaryl, then known as Sevin, was chosen because of its low toxicity to fish and wildlife, though it had never been tested on the looper--it had given fair results with the spruce budworm. The tests were conducted; the results were: DDT caused 99 per cent mortality, phosphamidon 90 and Sevin 86 per cent. Several other hurried tests were made with various formulations of Sevin with no improvement in results. Private industry decided that it would be necessary to use DDT on 14,810 acres of the most heavily infested timber. Because of the low toxicity of Sevin to fish and wildlife--phosphamidon is toxic to birds--it was decided to spray the remainder of the area with Sevin. Final results showed that Sevin killed only 43 per cent of the loopers--far too few to be significant in reducing tree mortality. As Paul Lauterbach mentioned in a previous paper, Sevin gave no control when compared to unsprayed areas. The decision then was not a good one in this case. The cost of the Sevin spraying was about $137,000.00.

Tests conducted in our laboratory in 1964 showed two important things. Sevin was not effective in controlling the hemlock even under controlled conditions and that other insecticides were available that could control the looper under these same conditions. Similar results were obtained from tests made at the Pacific Southwest Forest and Range Expt. Station under the direction of Dr. Art Moore. The moral here is that we should not use materials in the field until they have been tested in the laboratory--at least if we are interested in the economics of pest control.

RESULTS FROM AND FUTURE PLANS FOR RESEARCH ON SAFER AND LESS PERSISTENT INSECTICIDES TO REPLACE CHLORINATED HYDROCARBONS

by

Dr. A. D. Moore, Project Leader
Insecticide Evaluation Project
U. S. Forest Service
Pacific Southwest Forest and Range Experiment Station
Berkeley, California

Summary of Report

The Forest Service's new chemical insecticide project was activated at Berkely in January 1964. While the Pacific Southwest Forest and Range Experiment Station is administratively and technically responsible for the program, it was established to serve all of the Western United States. General guidance and direction, including priorities, location of studies, and balance of over-all effort rests with a steering committee.

Temporary quarantine facilities, insect treatment and holding laboratories, an analytical laboratory, and greenhouse facilities have been set up and equipped for the work. Additional laboratories and permanent quarantine facilities are being developed at Berkeley; and three mobile units--a central communication and office trailer, a chemical formulation vehicle, and a complete analytical laboratory on wheels--are being developed for field use.

The immediate goals are (1) to find nonpersistent (transient) insecticides that will be effective against spruce budworm and other defoliators, and (2) to develop application equipment and procedures that will minimize environmental contamination.

The research team is being organized into nine sub-units: (1) insect rearing--bioassay, (2) insecticide chemistry--toxicology, (3) insect physiology--biochemistry, (4) plant physiology--biochemistry, (5) spray physics and atmospheric physics, (6) application procedures and equipment, (7) field operations, (8) ecological aspects of chemical control, and (9) biostatistics.

In selecting candidate chemicals, preference is given to: (1) transient chemicals that would leave no toxic residue (including biologically active degradation products or metabolites) in the environment any longer than necessary to kill the target insect and, (2) chemicals that show a higher degree of biological activity against lepidopterous insects than against other insect orders and other biological organisms.

A number of chemicals have been tested for three types of biological activity: "knockdown" activity, direct contact action, and toxicity when ingested with host foliage. Also, small-scale field tests were conducted against the spruce budworm to obtain a frame of reference for the laboratory investigations. On the basis of this work, three materials are being considered for pilot testing against the spruce budworm this year--pyrethrin (I), Dibrom, and Zectran.

Pyrethrin is readily oxidized in air and this oxidation is catalyzed by ultraviolet light (sunlight). Therefore, it was necessary to find a means of stabilizing this material long enough to kill the target insects. A stabilized formulation has been found that looks good when exposed to sunlight on glass plates at winter temperatures in Berkeley. How effective it will be under operational conditions is not known. A field test will be conducted with this formulation in the near future.

Zectran is extremely toxic to spruce budworm and other lepidopterous targets. However, this material breaks down into biologically active metabolites that must be identified and studied in more detail before pilot testing. These studies are now underway.

The above materials are now being tested by the U. S. Fish and Wildlife Service in Denver to determine their toxicity to fish, birds, and game mammals. The major active breakdown products of Zectran will also be submitted to Denver for testing as soon as they are available in sufficient quantity. The U. S. Fish and Wildlife Service, the Montana Fish and Game Department, and the Montana Department of Public Health will also be cooperating in pilot tests with these chemicals.

Work has been started on application procedures and equipment that will direct spray applications more specifically toward the target insect and reduce environmental contamination. The U. S. Forest Service Equipment Development and Testing Center at Missoula, Montana, is providing engineering services for this work.

Because of the complex array of variables associated with the investigations, models constructed to represent the problems and objectives of the project will be programmed in various ways in an attempt to optimize the use of insecticides for specific target insects in the biological systems with which we are concerned.

RESULTS OF PILOT AND FIELD TESTS OF CHEMICALS FOR CONTROL OF FOREST INSECTS IN 1964

Chairman: F. B. Knight

CHEMICAL CONTROL OF DOUGLAS-FIR CONE AND SEED INSECTS USING SYSTEMIC INSECTICIDES

by

A. F. Hedlin

Tests were conducted in three different locations on Vancouver Island in 1964 using the insecticides Bidrin, dimethoate, Meta-Systox-R, Sumithion and SD-9129. Bidrin was applied at 0.35 per cent and 0.75 per cent active material in water; all others at 1 per cent and 2 per cent. All were applied as sprays to the cone-bearing portion of the tree crown.

The tests were against the Douglas-fir cone midge, Contarinia oregonensis, the scale midge, C. washingtonensis, the cone moth Barbara colfaxiana and the seed chalcid Megastigmus spermotrophus.

Bidrin, dimethoate and Meta-Systox-R gave good protection, particularly against the cone midge, scale midge and cone moth. In the area most severely infested seed loss amounted to 62 per cent on check trees. Trees treated with Bidrin (0.75 per cent), dimethoate and Meta-Systox (1.0 per cent and 2.0 per cent) received almost 100 per cent protection against insect-caused seed loss.

Light burn occurred on needles and bracts of some trees but this was felt to be insignificant.

DOUGLAS-FIR SEED AND CONE INSECTS STUDY

by

Benton Howard
Insect and Disease Control Branch
Division of Timber Management
U. S. Forest Service - Region 6

Time - Spring, 1964, May.

Place - Siuslaw National Forest, west of Corvallis, Oregon.

Agencies - Weyerhaeuser Company and U. S. Forest Service.

Who - Norman E. Johnson and Paul E. Buffam.

Insects
Douglas-fir cone moth, *Barbara colfaxiana*
Fir coneworm, *Dioryctria abietella*
Seed chalcid, *Megastigmus spermotrophus*
Scale midge, *Contarinia oregonensis*

Materials

1. Guthion - Applied when conelets were open and receptive to pollen.
2. Dimethoate (Cygon 267) - Applied at two different times:
   a. When conelets were green and receptive to pollen,
   b. When conelets were closed and pendant.

Dosage - Concentrate in water to equal 0.25 per cent by weight applied to point of runoff.

Application - By mistblower from truck-mounted ladder to individual trees.

Results

Late-Dimethoate treatment was excellent. Number of cone midges, midge-damaged seed, and chalcid-damaged seed were significantly reduced.

As a result of the spraying, late-Dimethoate treated cones were raised in quality from non-merchantable to merchantable; i.e., five or more sound seed per cut face.

Neither the Guthion nor the early-Dimethoate treatments significantly reduced insect damage.

The late-Dimethoate treatment appears very promising for Douglas-fir cone midge control. Studies are planned for the spring of 1965 to replicate the 1964 study. If similar results are obtained, recommendations can be made for operational use.

1964 FIELD TEST OF AERIAL SPRAYING FOR THE CONTROL OF SOUTHERN CONE INSECTS

by

E. P. Merkel[1] and D. E. Cole[2]

The Southeastern Forest Experiment Station and the Continental Can Company, Savannah, Georgia, cooperated in a study of the effectiveness of aerial spraying for cone insect control. The principal objective of the study was to control Dioryctria spp. coneworms and the slash pine seedworm, Laspeyresia anaranjada Miller.

The study area was a 20-acre slash pine, Pinus elliottii Englem., natural seed-production stand established in Emanuel County, Georgia, in 1956. The area had 25 to 30 seed trees per acre. Trees averaged 70 feet in total height and 14 inches d.b.h. in 1964.

A small Piper high-wing monoplane was used to spray 8 acres of the seed-production stand on April 10, May 12, and June 11, 1964. The remaining 12 acres served as the unsprayed check. Guthion was applied at the rate of 2.75 lbs. in 10 gallons of water per acre.

DuPont "Pontacyl" Carmine 2B dye was added to the spray formulation at the rate of 1 pound per 50 gallons for qualitative evaluation of spray coverage. The spray deposit was trapped on 4" x 4" pieces of green woodbine enamel paper. Spray deposit papers were placed at 1/2-chain intervals along four lines which ran perpendicular to the flight lines. Each line of spray-deposit cards cut across the entire sprayed and unsprayed plots. The unsprayed check plots, adjacent to the sprayed plots, showed no contamination from spray drift, based on visual evaluation of dye card deposits after each spray application.

The study design consisted of two blocks (replicates), each with a sprayed and unsprayed plot. Each plot contained 15 sample trees. Before the first spray application, each tree was climbed and all the sound first- and second-year cones were tallied on a single tagged sample-branch per tree. Dioryctria attacks were tallied before and after each spray application and finally at the time of cone harvest in mid-September. Since Dioryctria spp. attacks on cones were greater in the sprayed than in unsprayed plots after each spray no effective control was achieved.

However, the May 12 spray application gave definite evidence of controlling the seedworm, L. anaranjada, because 4 to 7 times more infested cones were found on unsprayed plots than on sprayed plots. However, due to a low seedworm population and lack of adequate treatment replication (blocks) the cone-infestation differences between sprayed and unsprayed plots were not statistically significant at the 5-per cent level.

It was apparent from the results of the experiment that more refined techniques are needed for sampling cone insect populations and the fate of aerial spray deposits in the tree crowns in order to accurately evaluate treatment effects in future aerial spray studies.

---

[1] Research Entomologist, U.S. Forest Service, Southeastern Forest Experiment Station, Olustee, Florida.

[2] Research Forester, Continental Can Company Inc., Savannah, Ga.

ZIMMERMAN PINE MOTH

by

J. W. Butcher
Department of Entomology
Michigan State University

The Zimmerman pine moth, Dioryctria zimmermanni Grote, attacks the main stem of Jack pine and Scotch pine in Michigan. It is primarily a Christmas tree pest and the feeding injury causes side branch mortality and sometimes top discoloration.

Early work at Michigan State University established that the insect overwintered in hibernacula under the bark scales of its host. Only stem drench sprays (BHC and thiodan are recommended) give effective control. These can be applied in the fall or spring.

Research is continuing upon taxonomy of the Dioryctria complex; biology and temperature requirements of developing larvae in relation to geographic distribution and foliage density of host trees.

FIELD TEST FOR CONTROL OF THE PONDEROSA PINE TIP MOTH, RHYACIONIA ZOZANA (KEARFOTT)

by

R. E. Stevens
(Read by C. J. DeMars)

In June, 1964, we conducted a one-shot-type field test for control of the ponderosa pine tip moth. This is a native western Rhyacionia, and is common in the Sierra Nevada. The work was done at the U. S. Forest Service's Badger Hill seed orchard near Placerville, El Dorado County, California. Placerville is in the foothills east of Sacramento.

Spraying was carried out by the foresters in charge of the seed production area--Carl Fowler and Leroy Johnson--and myself. We used a water emulsion spray of DDT applied with hand sprayers at a concentration of 2 pounds of DDT per 100 gallons of water. This formulation is effective for control of the European pine shoot moth, and we felt that it would likely be equally as effective against our tip moth. The insects were in the early larval stages, feeding on the needles and bark of the new shoots. They had not yet begun mining within the shoots.

The treatment turned out to be highly successful. None of the sprayed trees was subsequently damaged by tip moth activity in 1964, while adjacent unsprayed trees sustained damage comparable to that of previous seasons. No deleterious side effects of the spraying were observed. A Station Research Note telling just about what I have related here is in press and should be out in the next few weeks. A journal article and a Pest Leaflet on the biology of the tip moth are in preparation.

PILOT TESTS WITH MALATHION, DEMETHOATE, AND ZECTRAN TO CONTROL JACK PINE BUDWORM

by

D. O. VanDenburg

During the period of June 11 - June 17th, approximately 540 acres of jack-pine stands on the Huron-Manistee National Forest, in the lower peninsula of Michigan, were sprayed to field test several non-persistent insecticides against the jack-pine budworm (Choristoneura pinus).

These tests were conducted as a cooperative effort, with the Branch of Forest Insect and Disease Control and the Lake States Forest Experiment State personnel participating. The experiment station took the responsibility for developing the study plan and assisting in the analysis and interpretation of the resultant data. The staff entomologist on the forest was responsible for the operational aspects of the spray job with whatever assistance was necessary from the Regional Office.

The spray material was applied when 50 per cent of the larvae were in the fifth instar as determined by sampling one or two days before spraying.

The treatments were as follows:

1. DDT applied at 1 lb./gal./acre.
2. Malathion 1 lb./gal./acre.
3. Malathion ½ lb./gal./acre.
4. Zectran 1 lb./gal./acre water.
5. Cygon ½ lb./gal./acre water.
6. Check - no treatment.

There were three replications of the total gamut of treatments established on the Manistee National Forest. In addition there were six replications of the Malathion treatments alone established on the Huron.

Each treatment block was approximately 20 acres in size but the sampling was restricted to the central two acres.

All of the treatments were applied using a Bell G2-A helicopter as the spray vehicle. It was equipped with a Simplex High Volume Spray unit and a 50' boom. Flight speed was 40 MPH and the insecticide was released at a height of 50' above the tree tops.

Results and Conclusions

1. DDT, Zectran and both levels of Malathion resulted in significant population reduction over the check plots (.01 level).

2. DDT was not significantly better than Zectran and Malathion.

3. One pound of Malathion was significantly better than one-half pound (.05 level).

4. Cygon treatments were not analyzable because of replication loss and Zectran contamination.

It is unfortunate that less than the anticipated information was obtained from these tests. The portion of the test conducted near Mio on the Huron was inconclusive, possibly because of rain following the applications by only a few hours. Nevertheless, the Baldwin area did indicate that Malathion and Zectran at the one pound rate gave results comparable to DDT. Because of its high cost Zectran probably cannot be used operationally. Cygon appeared effective but because of the lack of replication no statistical significance can be assigned to the results.

It is desirable that this test be repeated in an abbreviated form before any insecticidal recommendations can be made. Malathion at the rate of one pound per acre and Cygon applied at one-half pound per acre would be the probable candidates.

Copies of the complete report are available upon request - Milwaukee, Wisconsin.

EFFECTS OF PERMA-GUARD ON THE SPRUCE BUDWORM

by

M. J. Stelzer

A small-scale test to determine the effects of an inert dust on the spruce budworm, Choristoneura fumiferana, was conducted in 1964 on the Lincoln National Forest, near Cloudcroft, New Mexico. The material used in the test was Perma-Guard, the proprietary name of a fresh water diatomaceous earth.

The effects of three Perma-Guard treatments, applied during the following periods in the development of the budworm larvae, were evaluated.

1. The first treatment tested was applied on April 14--prior to emergence of the overwintering larvae from the hibernaculum.

2. The second treatment was applied on May 20th when most of the larvae were mining in the buds.

3. The third treatment evaluated, was applied on June 3rd. At this time, the larva were in the third to the fifth instar and were feeding exposed on the needles.

To test each of the three treatments, 25 small budworm infested Douglas-fir trees were completely dusted with Perma-Guard and 25 trees left untreated to serve as the control. The rate of application was calculated by dividing the total pounds of Perma-Guard applied by the area of crown cover of the treated trees.

To measure the effects of the three treatments, the number of live budworm larvae on 10-ten inch branches collected from the trees 2-5 weeks after treatment was counted.

Larval counts on the control trees in the April 14th test averaged 3.6 as compared to 1.6 on the Perma-Guard tested trees, a reduction of 55 per cent with treatments. Counts on the trees in the May 20th test were 36.8 on the control and 26.2 on the treated trees, a reduction of 28 per cent with treatment. Comparable counts for the June 3rd test were 8.2 to 7.2 for a reduction of 12 per cent. The rates of application in the three tests ranged from 30 to 56 pounds per acre.

No differences could be detected in the degree of defoliation of the treated and untreated trees with any of the three treatments tested. In view of the high rates of application (30-56 pounds per acre) resulting in reductions of only 12-55 per cent in the budworm counts, it is concluded that Perma-Guard holds little promise for control of the spruce budworm.

RESULTS OF THREE SMALL-SCALE INSECTICIDE TESTS CONDUCTED BY WEYERHAEUSER COMPANY'S FORESTRY RESEARCH CENTER, CENTRALIA, WASH.

by

Norman E. Johnson

Hemlock looper

Ten insecticide formulations varying in concentration from 1/16 to 1/256 pound per gallon were sprayed on small hemlock branches on which were feeding 50 looper larvae. The spray containing a dye was applied until a filter paper behind the branch was lightly speckled in a pattern similar to that obtained during aerial spraying. The average per cent mortality for all concentrations is as follows:

Insecticide	Per cent mortality after 96 hours
Control (water)	0
Control (oil)	19
Meta-Systox-R	4
Dimethoate	36
Carbaryl (Sevin)	57
Phosphamidon	77
DDT in oil	88
Malathion	92
Pyrethrum	95
Guthion	97
Endosulfan (Thiodan)	99
DDT in water	100

Sitka Spruce Weevil

Twelve insecticides at 0.5 per cent active ingredient by weight were sprayed on Sitka spruce leaders with a hand atomizer. At the end of the season the number of weevil oviposition punctures were counted on each leader. The average number of punctures for the 14 trees in each treatment are listed below:

Insecticide	Number of egg punctures
Control	38.8
Malathion	31.0
Carbaryl (Sevin	22.7
Zectran	16.5
Bidrin	5.5
Heptachlor	5.3
Dimethoate	5.1
BHC	4.7
Meta-Systox-R	3.4
Guthion	2.7
DDT	2.4
Endosulfan (Thiodan)	2.4
Dieldrin	1.1

Douglas-fir cone and seed insects

Ten systemic insecticides were tested against cone and seed insects of Douglas-fir. The materials were applied by hand atomizer as 0.5 per cent solutions to cones on individual branches or at the rate of 0.5 ml active ingredient per 3/4 inch diameter branch by injection directly into the sap stream. Results against Contarinia oregonensis were as follows:

Insecticide	Number of Cone Midges per Cone Slice	
	Spray	Inject
Control	16.2	12.2
Bayer 25141	9.3	12.0
Bayer 37289	7.2	10.2
Schradan	10.8	0.0
Phosphamidon	7.6	1.4
Demeton	7.0	0.3
Bidrin	5.7	0.0
Meta-Systox-R	4.5	0.0
Dimethoate	2.6	0.6
Amer. Cyan 47031	3.0	0.0
SD9129	1.6	0.1

Several of the insecticides showed promise for control of Contarinia washingtonensis but none was satisfactory for control of Megastigmus spermotrophus.

PILOT TEST OF MALATHION FOR CONTROL OF THE GREAT BASIN TENT CATERPILLAR, MALACOSOMA FRAGILE. 1964

by

D. A. Pierce

In early June, 1964, Region 3 tested malathion for control of the Great Basin tent caterpillar infesting aspen stands on the Kaibab Plateau of northern Arizona. The National Park Service cooperated on the test. We planned to treat about 4,000 acres, about half on the Kaibab National Forest and half on Grand Canyon National Park. We only completed the part on the Kaibab Forest.

The objective of this test was to determine if an aerial application of 3/4 pound of actual malathion per gallon of fuel oil per acre would effectively control the caterpillar. A helicopter was used to apply spray.

The tent caterpillar is most easily controlled when the larvae are small, i.e., during the first three instars. Checks on caterpillar development were started the last of May. By June 5 most of the caterpillar eggs had hatched and some larvae were in the third instar. Spraying was to begin June 8 but was delayed by wind until the 10th. The project was terminated on June 14.

The results of the malathion treatment were determined by: (1) examination of tents two days after spraying and (2) comparing the results of an egg mass survey made in October, 1964, within the treated area with the egg mass survey made in the same area in the fall of 1963.

By examination of tents it was found that the malathion was highly effective in killing caterpillar larvae that were in the first three instars, but was not effective against fourth and fifth instar larvae.

The comparison of egg mass survey data for 1963 and 1964 follows:

Year	Trees Sampled	Average No. of New Egg Masses per Two 30" Branch Samples
1963 (prespray)	40	7.3
1964 (postspray	20	2.5

There were fewer egg masses found on branches sampled in 1964 than on branches sampled in 1963, but the number found in 1964 was still high. It is entirely possible that some of the egg masses could have been laid by females invading the narrow treatment strip from infested areas flanking the strip.

AERIAL PILOT TEST USING LOW VOLUMES OF UNDILUTED MALATHION TO KILL LARCH CASEBEARER LARVAE IN MONTANA. 1964

by

Scott Tunnock, Kenneth W. Keefe,
and Robert E. Denton[1/]

Summary

The larch casebearer (Coleophora laricella (Hbn.)) has steadily spread through the larch type of the northern Rocky Mountain region since it became established near St. Maries, Idaho, about 1953. By 1964, about 2 million acres or half the larch type in this region was infested.

Aerial applications of various insecticides to kill larch casebearer larvae have been tested since 1962. Malathion in fuel oil repeatedly killed high percentages of casebearer larvae. Results from tests with undiluted technical grade malathion, applied at the rate of 8 fluid ounces per acre by the Agricultural Research Service, indicated that excellent control of grasshoppers on Montana rangeland could be obtained. Advantages of applying technical grade material are numerous: solvents or carriers and mixing would be eliminated; storage and transportation costs of formulation materials would be greatly reduced; and the volume of spray material carried in an aircraft would cover a far greater acreage.

An aerial pilot test was designed to test the effectiveness of undiluted technical grade malathion against the larch casebearer during May, 1964. A dosage rate of 8 fluid ounces (0.6 pound of actual malathion) of undiluted malathion per acre was applied by helicopter over two plots. Two other plots were sprayed with a "standard" mixture of one-half pound of actual malathion in fuel oil at the rate of 1 gallon per acre.

The percentage of larvae killed by the 8-ounce rate was impressive --99.6 per cent within a 109-acre plot and 92.4 per cent within a 100-acre plot. Although the "standard" one-half pound per gallon killed 100 per cent on two replicates, it was applied at more than 1 gallon on many acres due to some miscalculations. However, during 1962, one-half pound in 1 gallon of fuel oil gave 89.6 per cent control and an average of 98.6 per cent control in 1963. This indicates that low volumes of technical malathion are as effective undiluted as when mixed with fuel oil.

A satisfactory spray system for low volume sprays by helicopters has not yet been developed.

1/ Respectively: Entomologist, Forester, Division of State and Private Forestry, and Entomologist, Division of Forest Insect Research; all with U.S. Forest Service, Missoula, Montana.

A FIELD TEST OF LINDANE FOR PREVENTION AND CONTROL OF ATTACK BY *IPS CONFUSUS* (LECONTE) (COLEOPTERA: SCOLYTIDAE) IN SLASH

by

R. W. Stark

Abstract

Lindane, used according to commercial specification (approximately 3.1 per cent con.), was completely effective in preventing attack by *Ips confusus* on ponderosa and sugar pine. Effective control in infested logs was achieved regardless of the time of treatment. Longevity of emerging brood adults was significantly reduced and there appeared to be a difference in susceptibility between the two hosts.

PILOT TEST RESULTS WITH MALATHION TO CONTROL THE SARATOGA SPITTLEBUG - APHROPHORA SARATOGENSIS

by

D. O. VanDenburg

On August 5 and 6, 1964, approximately 15 acres were sprayed with Malathion to determine its effectiveness in controlling the Saratoga spittlebug in the red pine plantations of lower Michigan.

Again, this was a project that involved the Branch of Forest Insect and Disease Control and the Lake States Forest Experiment Station working in cooperation.

Five replications consisting of four treatments each were spread over three red pine plantations infested with spittlebugs. The treatments were:

1. Check.
2. 1 pound DDT/gal./acre (Standard treatment).
3. 1 pound Malathion/gal./acre.
4. ½ pound Malathion/gal./acre.

All of the insecticides were applied with Kinkelder back-pack mist blowers calibrated to discharge 1 gal./acre at a walking speed of 200'/min. and a swath width of 35' (4 rows). All of the treatments were aimed at controlling the adult stage of the insect.

Pre and post sweep surveys were used to determine population levels.

The results by treatment were as follows:

1.	Check	1.87% reduction (normal)
2.	DDT 1 lb./gal.A	99.25% reduction
3.	Malathion 1 lb./gal./A	99.49% reduction
4.	Malathion ½ lb./gal./A	98.75% reduction

There was no significant difference between any of the chemical treatments and all were significantly better than the check.

Malathion appeared to kill adult spittlebugs more quickly than DDT. A cursory examination along the margins of the sample blocks within the treatment areas showed almost complete insect mortality four hours after treatment. At the same time adults were active in the DDT treated areas.

Malathion at one pound/gal./acre and one-half pound/gal./acre, applied by backpack mist blower and using panasol AN-5 as a solvent and diluent, appears to be an acceptable substitute for DDT. Further tests

are required and planned to determine if the same favorable comparison between malathion and DDT remains when the materials are applied from the aid. In addition, panasol AN-5 should be evaluated for possible insecticidal properties.

Copies of complete report are available on request from Milwaukee.

SUMMARY OF WHITE GRUB STUDIES IN MANITOBA - 1964

by

W. G. H. Ives and L. D. Nairn
(Read by F. E. Webb)

Methods

2-2 red pine and jack pine were planted. The seedlings were healthy, and were packed in moist moss at the nursery. They were planted at 6 x 6 ft. spacing using a modified Lowther tree planter. The following treatments were applied beneath red pine seedlings in two areas of the Sandilands Forest Reserve during the planting operation:

1. Emulsifiable aldrin - 10 cc of 2 per cent aldrin per seedling.
2. Emulsifiable aldrin - 10 cc of 4 per cent aldrin per seedling.
3. MAGAMP - controlled release fertilizer 8-40-0, at the rate of 33 grams per seedling.
4. MAGAMP and 2 per cent aldrin.
5. Control.

Limited tests of these chemicals were also made on jack pine, and of diazinon on red pine.

Grub populations were assessed in July, seedling mortality and growth in October. Mortality in the three 1963 plantations was also assessed in October.

Results

Mortality in 1964 Plantations

Grub populations were very low in both areas planted in 1964, and results are inconclusive. The percentage of seedlings killed by white grubs is as follows for each treatment:

Location	Grubs per cu. ft.	Aldrin 2%	Aldrin 4%	Aldrin & fertilizer	Fertilizer	Control
Wampum	0.16	1.4%	0.5%	0.8%	1.7%	2.1%
Whitemouth Lake	0.08	0.4%	0.6%	1.4%	1.3%	1.0%

Aldrin at both concentrations appeared to reduce the percentage killed by grubs. Fertilizer alone had no effect.

Mortality in 1963 Plantations

Mortality due to white grubs during 1963 and 1964 in plantations established in 1963 was as follows for the different chemical treatments:

Location	Percentages									
	Aldrin emulsifiable		Aldrin granular		Heptachlor emulsifiable		Toxaphene granular		Control	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
Agassiz	0.0	0.0	0.4	0.0	0.2	0.0	0.1	1.4	1.2	2.0
Marchand	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.1
Piney	0.5	0.0	0.0	0.3	0.3	0.4	0.1	1.6	0.5	1.9

These results are also inconclusive, but it seems that Aldrin in both formulations, and emulsifiable Heptachlor, may reduce white grub damage in the second year after planting. Toxaphene appeared effective the first year, but much less so in the second year.

Growth Response to Fertilizer in 1964 Plantations

Terminal growth in cm of red and jack pine receiving various chemical treatments was as follows:

Species	Fertilizer & 2% aldrin	Fertilizer	2% Aldrin	4% Aldrin	Control
Red pine	5.8	5.5	5.5	5.0	4.9
Jack pine	9.1	7.8	6.5	--	6.7

Both red and jack pine treated with fertilizer and 2% Aldrin had a significant increase in growth in relation to the control (at the .05 and .01 level). No other differences were significant. Jack pine showed a much greater response than red pine. Effects may be more pronounced in 1965, as most of the fertilizer is still undissolved.

Light Traps

Six battery powered ultraviolet light traps were operated near the 1964 planting areas in the Sandilands Forest Reserve. These traps were operated from 2230 to 0130 each night and were serviced once a week. Two other traps were operated in the Agassiz Forest Reserve. These were fitted with a device for separating the insects caught during each half hour period and were examined daily.

The main species caught in all three areas was Phyllophaga drakii, but small numbers of P. anxia, P. nitida and Serica spp. were also caught. The major flight period for P. drakii occurred during the two

week period June 4-18, and most of the flight activity for this species occurred during the period 2230-0130 hours. Cool or wet weather almost eliminated flight activity on several occasions. The critical air temperature for flight activity appears to be somewhere between 35 and 47 F. Ninety-seven per cent of all Phyllophaga caught in the light traps were males.

WORKSHOPS

Chairman - Dr. B. H. Wilford

WORKSHOP ON EUROPEAN PINE SHOOT MOTH

Moderator: Benton Howard

The Workshop was attended by ten.

Considerable time was spent in establishing a "frame of reference". Those from the West were almost totally ignorant of conditions in the shoot moth-infested areas of the Central Continent and in turn the others were not familiar with the Western ponderosa pine forests.

The validity and objectives of the program in the Northwest were questioned. A review was made of conditions. The philosophy of eradication was debated.

The objectives of the program in the Northwest were clarified. It was stressed that commitment for eradication had not been made. The goal is for ultimate eradication provided if (1) the accelerated research now being started developed a feasible method, (2) continued surveys did not discover infestations outside the present containment area around Puget Sound, and (3) containment and quarantine could be maintained. Periodic reviews will be made and objectives re-examined.

The difficulties and dangers of extrapolating research data from the Central Continent to the Western forests was recognized. The problems of projecting extrapolation Western-wide and for a forest generation were accepted. It was stressed that the Northwest program was a "reasoned one", and obviously was not based on direct evidence.

The status of research was discussed:

Northeast - Not much change.

Lake States - Nothing new.

Sault Ste. Marie - There is a possibility that some new work can be started.

Victoria - Expects to do studies on the moth on native ponderosa pine in the upper Okanagan Valley in British Columbia.

Northwest:

Washington State University

Sterilization - Dr. Berryman

Nutrition - Dr. Harwood

Pacific Northwest Forest and Range Experiment Station

Population behavior

Attractants - not yet determined

In the general discussions the following points were stressed.

1. The moth is a difficult one for the sterilization technique because of the enormous problem in mass rearing.
2. Population behavior studies are extremely important.
3. Dr. Green has reared the moth on artificial media.
4. No significant biological control has taken place.
5. No significant pathogenicity has been observed.
6. Studies should be conducted on ponderosa pine in its native environment in the West.

The moderator takes complete responsibility for the reporting.

CHEMICAL CONTROL OF BARK BEETLES

Moderator: D. A. Hester

While our topic was "Chemical Control of Bark Beetles" we wandered off the subject at times and, in fact, more nearly covered "Control of Bark Beetles".

The question has often been raised whether or not we can control a bark beetle epidemic with chemicals. The group felt that chemicals were good. The weakness is not in the chemical but rather in the overall method of application. This is all inclusive, including spotting and all aspects of a project.

There was apparent agreement that too many jobs are not thorough enough. This results in having to cover the same ground several years in a row. Hot spotting is of doubtful value though a common practice due to built-in problems relating to large areas, costs, and limitations on time and money.

There was considerable discussion on whether or not we should attempt any control of bark beetles. The conclusions were that control is here to stay. For this reason we must take a positive attitude and be prepared to take advantage of research developments as rapidly as they are developed.

Lindane has been successfully used but has not as yet replaced EDB on most Dendroctonus control projects.

One thing that came up often was the effect of public pressures for doing control work. Such pressures are often the deciding factor in determining whether or not we attempt control. From an entomological standpoint this is not good but is a fact of life and we might just as well plan to live with it.

There were definitely two schools of thought on the effect of chemical treating on predacious and parasitic insects. One thought was that under some conditions we may be doing more harm than good in treating trees or portions of trees. The other thought was that native insects have little or no effect on the control of bark beetle epidemics.

LABORATORY REARING OF LEPIDOPTERA

Moderator: M. E. McKnight

The session was attended by Hedlin, Rose, Lewis, VanDenburg, Furniss, Germain, and Borg.

Lepidoptera may be reared in the laboratory for several reasons. These include (1) Identification; (2) Parasite recovery; (3) Life history and biology studies; (4) Maintenance of stock cultures for bio-assay, host material for pathogens or parasites, etc.; (5) Nutritional studies and (6) Genetic or physiological studies. The criteria of the rearing regime may change with the objective of the rearing.

Mr. Furniss presented a set of problems attending the rearing of a looper from Mountain Mahogany for a life history study. The use of an artificial medium for food and changes in caging techniques may help his situation.

Mr. Hedlin described his techniques of rearing cone insects on an artificial medium for tests involving variations in temperature and photoperiod.

Mr. Rose has the task of rearing for identification hundreds of species resulting from survey collections. Each species has its particular requirements for food, light, temperature, humidity, and pupation site which must be satisfied. Increased day length has been used to bring to maturity species that would normally overwinter.

Some miscellaneous notes:

1. Adaptation of the wheat germ based artificial media are being used for a broad spectrum of insects including leaf-feeders, wood borers, and cone insects. Some species apparently need the addition of a natural stimulant such as freeze-dried foliage to induce them to begin feeding on artificial media.

2. In the laboratory it may be difficult to obtain normal adult mating and oviposition. It is important, therefore, to know the natural requirements in the field so that they may be approximated in the laboratory.

3. Many forms of malformations in the immature and mature stages may be expected. These may result from nutritional variations, crowding, or other abnormal conditions.

4. Overwinter storage is a major problem with some species. Mr. Lewis suggested that steady state storage may be more harmful than storage with more natural temperature fluctuations. Since overwinter storage is, in effect, an attempt to "break diapause", studies of diapause stimuli and diapause development are needed.

5. Diapause intercepts the life cycles of several species reared in the laboratory. Some workers stagger generations to provide constant supplies of insects. Other workers attempt to form nondiapause strains. This latter practice seems undesirable since unpredictable changes in the populations may accompany loss of diapause behavior.

CONE AND SEED INSECT WORKSHOP

Moderator: J. A. Schenk

Members attending:

R. A. Goyer, University of Idaho
H. G. Kinzer, New Mexico State University
E. P. Merkel, Region 8, U.S.F.S.
J. Bean, Region 7, U.S.F.S.
N. E. Johnson, Weyerhaeuser Timber Co.
K. H. Wright, PNW Expt. Sta., U.S.F.S.
A. F. Hedlin, Can. Dept. Forestry, Victoria, B.C.
R. Blomstrom, Region 5, U.S.F.S.
C. Kirby, Can. Dept. Forestry, Ontario.

I. Biology, Ecology and Bionomics:

A. Cone collections were made from Douglas-fir, Engelmann spruce and ponderosa pine trees in New Mexico. Examination of those from the pine revealed that 80 per cent were infested by insects. The most damaging insect species were Conophthorus scopulorum (responsible for 50 per cent of the damage), Megastigmus sp., Laspeyresia sp., and Dioryctria sp. (H. G. Kinzer).

B. Preliminary surveys of the cone and seed insects of balsam fir, white pine, and red spruce in the N.E. states was initiated by the Region 7 office of the Forest Service. Species of Dioryctria, Conophthorus and Megastigmus appear to be the most destructive groups in the area surveyed. Further information is available in pamphlet form upon request (J. Bean).

C. Seed losses were ascertained in western white pine seed production areas (plantation) in northern Idaho in two replicated plots of four different tree densities (8 x 8, 20 x 20, and 30 x 30 feet, and natural-mixed). Preliminary, non-statistical, examination of three-years' data suggests a strong relationship between loss and stand density, and seed loss and collection date. The lowest seed losses occurred in plots of 8 x 8 foot spacing and in the natural-mixed plots; the greatest, in the 30 x 30 foot spacing. Losses in plots of 20 x 20 foot spacing were intermediate, but nearer those in the least dense plots. Seasonal progression of attack by the various insect species or species groups also was ascertained in the study area. (J. A. Schenk & R. A. Goyer)

D. There is a definite need for standard base or unit to express seed losses (K. Wright). Number or proportion of cones infested relatively meaningless, except in reference to Conophthorus spp., which destroys entire cone. (Consensus)

E. More work is needed in the field of population sampling and dynamics (Consensus). Importance of representative sampling of crown portions was emphasized (N. Johnson).

F. The biology and effectiveness of the parasites of Eucosma rescissoriana in western white pine cones are in process of study. The major species include two braconids, Apanteles starki and

Chelonus n. sp., and an ichneumonid, Pimplopterus n. sp. Parasitism by these species averaged 11.5 per cent in 1963 and 17 per cent in 1964. Biologies are being studied by bagging techniques in the field, supplemented by individual rearings in the laboratory. (R.A. Goyer)

G. Miscellaneous observations:

1. Frost often causes 100 per cent mortality of tree flowers and the insects infesting them (N. E. Johnson).

2. Both squirrels and Dioryctria spp. show preference for cones from fertilized slash pine (E. Merkel).

II. Control of Cone and Seed Insects:

A. Many seed orchard managers in the northeast are requesting the development of a spray schedule similar to those used in fruit orchards (J. Bean).

B. Zectran, Dibrom, and Sevin all show promise in the control of C & S insects (E. Merkel).

C. Foliar spray (hydraulic) applications of systemics are the most practical and effective method of control, especially in seed production areas, but complete coverage of foliage and cones is mandatory for success (E. Merkel & N. E. Johnson). Trunk implantation or bark application methods requiring individual tree applications may be warranted in high value seed orchards (Consensus).

D. A pilot study has been initiated to ascertain the feasibility, effectiveness and side effects of Metasystox-R (methyl demeton) in the control of Douglas fir cone insects. Bole injection of 24 grams of toxicant/tree (9-14" dbh) was accomplished by means of Mauget tree injector units. Results (as yet unverified statistically) indicate satisfactory control of Barbara colfaxiana and a dipterous gall midge. Preliminary and concurrent investigations by co-workers in related fields (Dr. R. Giles and Prof. F. Johnson, College of Forestry, University of Idaho) have shown no deleterious effects on indicator rodent species fed treated seed, nor any gross phytotoxic symptoms. Additional and more intensive studies, using higher dosage rate/tree, are planned for 1965. No visible effect on sawflies or Douglas fir tussock moth feeding on treated trees. (J. Schenk)

III. Rearing Techniques:

Good results were obtained in the use of the bollworm rearing medium in individual laboratory rearings of B. colfaxiana and Laspeyresia hedula. Primary problem arises in moisture control. (A. Hedlin)

The workshop concluded with a discussion of new equipment--costs, and adaptability to various research and applied uses.

WORKSHOP ON DOUGLAS-FIR TUSSOCK MOTH AND TENT CATERPILLARS - RESEARCH AND CONTROL

Moderator: D. L. Dahlsten

Participants - Cliff Brown, Bob Fisher, Ralph Hall, Rick Johnsey, Pete Orr, Don Pierce, John Pierce, Don Renlund, Dave Scott, Milt Stelzer, Galen Trostle, and Scott Tunnock.

There was no formal outline followed for this workshop and because of the interest in the Douglas-fir tussock moth most of the discussion was centered around this insect. The discussion was confined mainly to aspects of control due to the large areas that have been proposed for control in the western United States this year. Microbial control of tent caterpillars was discussed briefly.

Research activity on the Douglas-fir tussock moth is limited to three projects. The U. S. Forest Service's Corvallis laboratory is working with a polyhedrosis virus of the tussock moth and they have tentative plans for tests with the virus this summer. The Division of Entomology and Acaraclogy at the University of California at Berkeley is initiating an extensive pupal and egg mass sampling program in hopes of finding a suitable population evaluation technique. The Division of Biological Control at the University of California at Berkeley began a long-term population investigation in the summer of 1964 with particular emphasis on the parasite complexes. The biologies of tussock moth parasites are being studied in this program too.

Several problems pertinent to the control of the tussock moth were discussed. The group was fortunate in having Mr. Don Renlund in its midst as he was able to add many new ideas and make some interesting comparisons from his experience with a pine tussock moth in Wisconsin. Dispersal behavior of the Douglas-fir tussock moth apparently varies considerably from one region to another. For example, larvae in some areas will drop from the foliage on a silken strand when disturbed either by making noise or by hitting the branch while larvae in other areas are more tranquil. Daily movements of larvae up and down the bole of the tree were noted in Oregon but not in any of the other areas. This topic was terminated by a rather lengthy discussion on the role of man in spreading the tussock moth versus the role played by the wind.

The amount of tree mortality caused by tussock moth defoliation was thought to be greater than with other defoliators. Top killing of trees was noted to be particularly characteristic of this moth. However, there was considerable question as to how much tree mortality this moth actually causes. Site differences were mentioned as a possibility for variation in tree mortality. As to the control decision, there are two factors involved. Some groups claim that they can withstand only slight defoliation as they are dealing with natural regeneration Christmas tree sites. Other groups are interested only in protection against tree mortality. Further research on the effects of tussock moth defoliation on tree mortality was felt to be greatly needed.

Rearing difficulties in the laboratory have been experienced by workers in California but much of this was found to be due to a trans-ovum

transmitted polyhedrosis virus. Other investigators in Montana have found that the larvae can be reared easily by applying small amounts of free water to the foliage.

Timing of the spray application was mentioned as a particular problem in areas that are managed for Christmas trees. Marked tips, observation areas, and cutting tips and bringing them into the laboratory were mentioned as possible techniques to determine the percentage of larval eclosion. Post control evaluation was also mentioned as a difficult problem as no larval sampling techniques are available. The feeding habits of this insect make this a particularly difficult problem.

Most of the members of the workshop felt that DDT was the only insecticide that could be used. Other chemical insecticides were suggested but no one knew of anyone that was going to conduct any experiments along these lines. The polyhedrosis virus may be applied experimentally. Another microbial insecticide, Bacillus thuringiensis, was also mentioned as a possibility for experimental work.

SUMMARY OF WORKSHOP ON INSECT STERILIZATION

Moderator: A. A. Berryman

A. Problems associated with the application of the sterility principle to forest insects.

1) Rearing. One of the basic necessities for the success of a sterile release program is the ability to produce large numbers of the insect. This problem has been at least partially solved for forest defoliators by the use of the pink bollworm diet, on various modifications of this medium. Even Cerambycids have been reared successfully on this diet. Bark beetles have been reared successfully on a ground phloem medium and it seems likely that they might also take to the pink bollworm diet. The major problem with bark beetles is to obtain oviposition on the artificial or semi-artificial diet. With cerambycids, this problem is solved by incorporating plant material in the artificial diet.

The possibility exists of treating bark beetles with radiation or chemosterilants in the field. This could be achieved by using sex attractants to draw the population into the device which applies the treatment.

2) Sampling. Before releasing large numbers of sterile insects it is necessary to have some idea of the size of the wild population, in order to insure that this population is flooded by the sterile insects. The development of sampling techniques for the pest is therefore of primary importance.

The size of forest insect populations is in itself a problem, requiring the artificial propagation of huge numbers of insects for sterilization. The screw worm, even in epidemic years, only reaches population densities of about 100 individuals per square mile. What densities are obtained in most forest insect populations? Conventional control methods may possibly help by reducing the population to a size conducive to flooding with sterile insects. Another alternative is to release during periods of low population; e.g. the spruce budworm in Canada is at a very low level at present.

3) Chemosterilants. Chemosterilants are in use, combined with Gyptol, against the Gypsy moth. However, there is no indication, as yet, of the effect of this program on the moth.

A major problem with the chemosterilants in present use is that they seem to cause lethargy and inactivity in the treated insects. Chemosterilants are alkalysing cytological poisons which act on tissues other than those of the reproductive system. This is particularly true when the chemical is fed to the insect (e.g. in an artificial diet) and has to pass through the metabolic processes.

Resistance to chemosterilants has been reported and this poses another problem when field application is visualized. Chemosterilants are dangerous cytological poisons and affect man and other animals.

4) The "oxygen effect". Radiation striking oxygen and hydrogen in the body tissues causes the formation of peroxides. These peroxides are mild poisons effecting enzyme systems and cell division. Thus the presence of oxygen tends to increase the effect of irradiation on the genetic material. The importance of this phenomena is that insects in an oxygen deficient atmosphere require almost twice the radiation dosage to cause sterility. Therefore insects should be treated in an open container, or if placed in an airtight receptacle treatment should be applied immediately.

B. Effects of gamma irradiation on insect sperm.

In the screw worm treatment is applied in the late pupa when much of the sperm have already been formed. The radiation prevents further spermatogenesis and produces a dominant lethal gene in the sperm. These sperm are otherwise functional, being capable of entering and fertilizing the ovum. However, the dominant lethal gene is transmitted to the embryo which dies at some stage during its development. A similar effect is apparent in the Gypsy moth.

An interesting phenomenon has been noted in the white pine weevil. In this species the female mates several times. If the female is mated alternately with fertile and sterile males then she will lay batches of fertile and sterile eggs which reflect her mating activity. Thus even in a multiple mating species the effect of sterility is apparent, even when mating occurs with both wild and treated males.

C. Other methods of inducing dominant lethal effects.

In the Gypsy moth mating different strains resulted in the production of infertile female intersexes. Males of the Japanese "strong" strain when mated with females from the "weak" strain produce 100 per cent sterile female intersexes and 50 per cent "strong" and 50 per cent "weak" males. In the F_2 generation all the males are "strong" and only 50 per cent of the females are sterile.

Possibilities were mentioned for using strains, races or similar species or subspecies, which when mated may produce sterile hybrids.

D. Present work involving forest insects.

Scientist	Insect	Sterilizing source
R.W. Stark, D.L. Wood	Ips confusus	Gamma
D.L. Wood, R.W. Stark	Sawflies	Gamma
P.A. Godwin	Gypsy moth	Gamma, chemosterilants
P.A. Godwin	White pine weevil	Gamma
A.A. Berryman	European pine shoot moth	Gamma, chemosterilants

---

Author's Note: In order to obtain the maximum information out of this workshop the moderator did not keep track of the origin of the material. He therefore acknowledges the panel as a whole as the source of this discussion and takes full responsibility for mistakes or misinterpretation.

ETIOLOGY OF EPIDEMICS

by

Moderator: W. P. Nagel

A general discussion relating to qualitative (genotypic) changes in species populations during changes in abundance. The interpretation of such changes in reference to understanding causes of increases or decreases in population numbers was the focal point of the Workshop.

It was recognized that there are often different genetic populations of the same species and that these can undergo changes in genotypic proportions when progressing through a gradation or fluctuation of numbers in time. Such genotypic changes manifest themselves in morphological, physiological, or behavioral phenotypic changes which can influence the dynamics of a given population.

Dr. Ian Campbell presented data on Malacosoma disstria populations paralleling those found by Dr. Wellington with Malacosoma pluviale. Dr. Campbell has identified four colony types of M. disstria which differ morphologically and behaviorally. The less active colonies predominating during endemic levels are composed of smaller larvae and weak flying adults but which lay larger eggs. The requirements for terminating diapause are different in these large eggs than in smaller ones and as such affect the hatching and survival of the following generation; which, Dr. Campbell has observed, is related to spring temperatures and the subsequent flush of host flowers and foliage. During the epidemic stage of a gradation the colonies are more active, the adults larger and stronger fliers, and the eggs smaller. Colonies of this type, when under "stress", will eventually change to the smaller type.

How such genotypic changes are manifested in bark beetle populations were also discussed. It was felt that behavioral and physiological differences in phenotypes would be more apt to be observed than morphological ones. Behavioral differences in response to various "attractants" have already been observed in species of Ips and Dendroctonus.

It was agreed by the Workshop that qualitative changes in populations are important in understanding and explaining the causes of outbreaks and that recognition and quantification of these changes should be a major aspect of long-term studies in population dynamics.

RADIATION STERILIZATION OF INSECTS

by

Dr. R. C. Bushland
Director, Metabolism and Radiation Research Laboratory
Entomology Research Division, Agricultural Research Service
United States Department of Agriculture

As early as 1916 Runner observed that cigarette beetles given heavy doses of X rays were either killed or rendered incapable of reproduction. He suggested that such radiation might have value for the treatment of infested tobacco, but his findings were not followed. In 1927 Muller discovered mutagenic effects of radiation on Drosophila, and his findings were widely adopted by geneticists seeking means to increase the mutation rate in insects. Geneticists were most interested in radiation induction of non-lethal genetic markers, but they also observed recessive lethal and dominant lethal effects. It soon became well known among geneticists that massive doses of X- or gamma radiation could produce dominant lethals in every sperm and every egg of the irradiated insects and hence render them sterile. However, at that time no one considered making practical use of this information for insect control.

Screwworms are obligatory parasites of domestic animals in tropical and subtropical areas of the Western Hemisphere. In their northern range, the population survived the winter in the southern parts of states bordering Mexico and spread over the West and Midwest each summer. In 1933 the insects were introduced into the Southeast, presumably through shipment of infested cattle, and became established as a separate population surviving the winter in peninsular Florida. USDA workers studying the biology and control of screwworms noted that because of the restricted breeding habitat and chemical control of infestations in livestock, populations seldom exceeded 100 adult males and 100 females per square mile. Laboratory procedures were developed for economical mass culture on the insect whereby approximately 1000 larvae could be reared under incubator conditions on a pound of ground meat mixed with blood, water, and preservative. In laboratory cages the adults began mating after they were two days old and by the age of five or six days most of the females were inseminated. Males continued to pursue the older females, but they avoided mating.

In 1938 Knipling speculated that since the females appeared to be monogamous and the population in nature was low and could be economically outnumbered by laboratory-reared insects, that it might be possible to use sterile male screwworms to eradicate the newly established southeastern population if some way could be found to sterilize males without adversely affecting their field survival and mating behavior. This proposal was not followed seriously until 1947 when at the USDA's Kerrville, Texas, laboratory entomologists began exploratory tests for chemosterilants. Of the chemicals tried at that time none worked.

In an article in the American Scientist published by Muller in 1950, the sterilizing effects of radiation were called to our attention. We therefore exposed screwworms to X-irradiation and found that pupae could be easily sterilized. This was followed by laboratory work with

gamma rays from Cobalt 60 with similar success. Concurrent field tests conducted in Florida from 1951 to 1953 showed sufficient promise to justify an eradication experiment on the island of Curacao in 1954. Following this successful test, mass culture, sterilization, and distribution techniques were developed and tested in Florida field trials. In 1958 the Animal Disease Eradication Division of the USDA, with the technical advice of the Entomology Research Division, worked in cooperation with livestock health agencies of the southeastern states to execute an eradication program which was successfully completed in 1959.

In 1962 a program was initiated in the southwestern states, and in two years overwintering populations were eliminated from Texas, New Mexico, and eastern Arizona. A living barrier of sterilized flies, distributed by air and constantly replenished, is successfully preventing reestablishment of screwworms in those states. This barrier is chiefly in northern Mexico and extends from the Gulf of Mexico to eastern Arizona, eliminating screwworm losses in those parts of the United States east of the Rockies. Another overwintering population exists in California and southwestern Arizona. Plans are being developed to extend the program to include those areas and most of Mexico so that the insects can be eliminated far from our borders and confined by a more economical barrier across the short distance from the Gulf to the Pacific in southern Mexico.

Radiation sterilization has also proved effective in recent laboratory and field trials against various fruit flies, and its use seems certain to be extended to other insects where special situations make this technique economically practical.

Chemical sterilization of insects is a more recent development since the discovery of male sterilants for houseflies at the Orlando, Florida, laboratory of our Division in 1960. It may be applied merely as a variant of the existing radiation technique in order to avoid somatic damage to some insect species that do not tolerate sterilizing doses of radiation. However, chemosterilants show greatest promise as a means of inducing sterility in natural populations of insects in the field. At present, because of safety considerations, most emphasis is directed towards limited application using baits or other means of attracting insects to chemosterilants confined so that only the insects are exposed. For the future it is hoped, as knowledge increases and chemicals active only against insects can be developed, that chemosterilization may be greatly extended to supplant or supplement toxicants in insect control.

RECENT ADVANCES AND FUTURE PLANS IN FOREST INSECT CONTROL RESEARCH

Chairman: Dr. C. L. Massey

EXPERIMENTAL FIELD STUDIES OF THE STERILE MALE RELEASE TECHNIQUE FOR THE SUPPRESSION OF GYPSY MOTH POPULATIONS

by

Paul A. Godwin
U. S. Forest Service, Northeastern Forest Experiment Station, Forest Insect and Disease Laboratory, West Haven, Connecticut

Abstract

Studies of the effects of gamma irradiation on the gypsy moth were begun at the Northeastern Forest Experiment Station in 1957. These studies established that hatch of eggs from females mated to treated males could be reduced to less than one per cent, with little or no somatic damage, if 9-day-old male pupae were exposed to 20,000r.

On the bases of these studies a small field experiment, in cooperation with the Methods Improvement Laboratory, Plant Pest Control Division, ARS, was undertaken.

The experiment was conducted in pure pine plantations in the Myles Standish State Forest, Plymouth, Mass. Within the plantations, 2-acre study plots, approximately one mile apart were selected.

The insects for the test were field-collected as prepupae and held in the laboratory until they were 8- to 10-day-old pupae. These were then irradiated at the Brookhaven National Laboratory. They were exposed to 20,000 roentgens using a Cobalt-60 gamma source with a dosimetry of 284,000r./hr.

Ninety female pupae and 90 nonirradiated male pupae were placed in each 2-acre plot. Two of these plots also had 900 irradiated male pupae placed in them--a ratio of 10 irradiated males to one nonirradiated male. Two plots had 2,250 irradiated males placed in them--a ratio of 25 irradiated males to one nonirradiated male. Two plots had an additional 4,500 irradiated males placed in them--a ratio of 50 irradiated males to one nonirradiated male. To serve as controls two plots had no irradiated males added.

Bird predation and eclosion failures reduce male ratios to an estimated 10:1, 17:1, and 33:1.

Egg hatch from control plots was 62 per cent. At the 10:1 male ratio egg hatch was 32.7 per cent, or a reduction of about 48 per cent from controls. At the 17:1 male ratio egg hatch was 15.2 per cent, or a

76 per cent reduction, and at the 33:1 male ratio egg hatch was 13.4 per cent or a reduction of about 80 per cent.

Failure to achieve expected reduction can be attributed to one or more of the following:

1. Treated males were not completely competitive with untreated males.

2. The irradiation did not reduce male sterility to the degree expected.

3. The estimates of irradiated male to nonirradiated male ratios were poor because of influx of an unknown number of natural males or the differential flight from the study areas of irradiated males.

4. The influx of irradiated males into the control areas.

THE INFLUENCE OF HOST MATERIAL ON PHEROMONE POTENCY OF IPS CONFUSUS LECONTE

by

G. B. Pitman
Boyce Thompson Institute for Plant Research
Grass Valley, California

Data accumulated during the summers of 1963 and 1964 indicated that response dissimilitudes to field olfactometers, baited with ponderosa pine billets infested with male Ips confusus, were related to the osmotic values of the expressed phloem sap. Trees with phloem tissue low in soluble carbohydrates appeared less favorable as a dietary medium for pheromone synthesis. This conclusion was demonstrated experimentally by interrupting the sieve elements in ponderosa pine for various periods of time. The field population of Ips confusus preferred olfactometers baited with infested billets taken distally to one month and one year old girdles. Similar results were obtained using billets from above naturally occurring trunk girdling stem cankers of the Western Gall Rust (Peridermium harknessii J. P. Moore).

Dissimilitudes in response to field olfactometers were also related to the various heights of the stem from which the billets were obtained. Consistent in two separate studies, male Ips confusus forced into billets from the upper stem portion were capable of eliciting a greater response than males in the lower stem portion.

RESEARCH PROGRESS ON IDENTIFICATION OF THE SEX PHEROMONE OF IPS CONFUSUS

by

D. L. Wood

In May, 1964, the University of California and the Stanford Research Institute began investigations aimed at evenutal identification and synthesis of the male-produced sex attractant of Ips confusus. Extraction, separation and other aspects of chemistry are under the direction of Robert L. Silverstein of SRI. These complimentary programs are being supported principally by grants from the U. S. Forest Service.

We are producing male frass in as large a quantity as resources will permit. Logs are brought in from the field with broods in the adult stage and placed in rearing. After collection and sex determination, males are released in cages with green logs and the boring dust containing the attractant collected. Average male productivity is 10 mg per day and lasts for approximately 18 days. We are averaging 300-400 grams per week which means 4,000-6,000 males are producing boring dust continuously.

The bioassay currently being used is based on an olfactometer design already described. A refinement of this method which utilizes groups of beetles released simultaneously was illustrated. The assay is quantitative as well as extremely sensitive. A detectable response is evoked by solvent dilutions of an extract equivalent to 4×10^{-9} grams of frass which is about that produced by one male in 1/30 second.

BACILLUS THURINGIENSIS FOR CONTROL OF DEFOLIATORS

by

Franklin B. Lewis
U. S. Forest Service, Northeastern Forest
Experiment Station, Forest Insect and Disease
Laboratory, West Haven, Connecticut

Abstract

A series of field and laboratory experiments with Bacillus thuringiensis for the control of the gypsy moth, Porthetria dispar (L.) was discussed. These tests covered the years 1961-1963.

The results of the airplane spraying tests showed that the physical characteristics of the wettable powder formulations interfered with the proper application of the finished formulations. The 1963 test using an emulsifiable liquid Bt concentrate, showed that stabilizers in the concentrate interfered with the feeding activity of the larvae and changed the physiology of the Bt organism.

The laboratory tests showed that the gypsy moth larvae were susceptible to alkali-dissolved crystals, crude exotoxins, and toxins produced by the multiplication of the vegetative cells in the gut of the larvae.

Recent (1964-1965) laboratory tests with Thuricide 90 TS Flowable and Biotrol 183 indicate these preparations, in field use, should give acceptable control of the gypsy moth.

ARTIFICIAL INITIATION OF VIRUS EPIZOOTICS IN FOREST TENT CATERPILLAR POPULATIONS *

by

G. R. Stairs (Read by W. A. Reeks)
Insect Pathology Research Institute
Sault Ste. Marie, Ontario.

A nuclear-polyhedros virus was introduced into virus-free populations of the forest tent caterpillar, Malacosoma disstria (Hübner) in 1963. The virus caused mortality only on the treated trees in 1963 but in 1964 virus was spread into the surrounding areas from the points of introduction. The extent of spread appeared to be influenced by the size of the area treated in 1963. In one area 0.6 acres were treated in 1963 and virus mortality was observed over an area of 3 square miles in 1964. Similarly, in another area 4.0 acres were treated and the virus was spread over 400 square miles in 1964. Infected adults that transmit virus to their progeny appeared to be the chief means of spreading virus over such wide areas. In localized areas adults of the dipterous parasite, Sarcophaga aldrichi Park, may be important dispersal agents of disease because they feed on dead, virus-diseased larvae and become contaminated with virus. These adults then fly to all parts of the tree contaminating foliage on which healthy larvae are feeding. They are present from the time caterpillar larvae enter the third instar until after adults have oviposited.

* Detailed paper to be published in Canadian Entomologist.

RESULTS OF A PILOT TEST TO CONTROL A TENT CATERPILLAR WITH PATHOGENS

by

M. J. Stelzer

Introduction

In 1964, a cooperative pilot test to control the tent caterpillar, Malacosoma fragile incurva Hy Edw. with an aerial application of two disease-producing microorganisms, was conducted by the Rocky Mountain Forest and Range Experiment Station and the Region 3 Division of Pest Control.

A helicopter was used to apply a single dosage of a nuclear polyhedrosis virus and the bacterium, Bacillus thuringiensis to approximately 80 acres of infested cottonwood and willow in the Sabino Canyon Recreation Area near Tucson, Arizona. The rate of delivery was 2 gallons per acre of a 20 per cent corn syrup-water formulation containing 50 billion polyhedra and 30 ml. of a commercial Bacillus preparation, Thuricide 90T. About 70 per cent of the tent caterpillar larvae were in the third instar at the time of treatment.

To measure spray deposits, agar filled petri dishes were exposed to the spray at 30 localities in the study area. After exposure the dishes were closed, incubated at room temperature for 24 hours, and a count made of the number of Bacillus colonies that developed. This technique has been used by the Northeastern Forest Experiment Station to assess Bt deposits in Gypsy moth studies.

Two methods were used to determine the effects of the spray on the tent caterpillar.

In the first method, about 2 hours after spraying, dacron sleeve cages (44 inches long by 15 inches in diameter) were placed on 10 cottonwood and 10 willow trees in the spray area and also in an adjacent untreated area. The cages were stocked with 25 larvae and examined 24 days later to determine the percentage of larvae killed by virus.

In the second method, larval colonies in the treated and control area were periodically examined and the presence or absence of virus killed larvae recorded.

The results of the sleeve cage study showed:

1) No virus mortality occurred in any of the sleeve cages in the control area.

2) In the treated area, larvae killed by virus were present in 100 per cent of the sleeve cages on cottonwood and 60 per cent of the cages on willow.

3) The rate of virus mortality in the cottonwood cages ranged from 4-44 per cent and averaged 27 per cent.

4) Similar figures on willow were 0-20 per cent with an average of 7 per cent.

As mentioned earlier, spray deposits were determined at 30 localities in the study area by exposing agar filled petri dishes to the spray and then counting the number of Bt colonies that developed. These counts ranged from 213 to 1,575 colonies per dish, with an average count of 750.

Tent caterpillar colonies were periodically examined for virus killed larvae in the immediate vicinity of each of the 30 spray deposit localities and the per cent of infected colonies computed. Similar observations were made in the control area.

The results of these examinations, summarized at 9, 15, and 24 days after treatment, showed the following:

1) Of 62 colonies examined in the control area, only one colony was found to contain a virus-killed larva. This was recorded on the examination at the 24th day.

2) On cottonwood, the per cent of the colonies containing virus killed larvae increased from 44 per cent at 9 days to 62 per cent at 15 days and to 81 per cent at 24 days after treatment.

Comparable figures for willow were slightly lower, ranging from 27 to 47, to 66 per cent at 9, 15, and 24 days after treatment, respectively.

The reason for the lower incidence of infection on willow was probably due to the fact that at the time the area was sprayed, foliage development was more advanced on the cottonwood trees, thus presenting a greater surface area for spray deposit.

In conclusion, although virus mortality did not exceed 44 per cent in any of the sleeve cages, the occurrence of infected larvae in over 80 per cent of the colonies may result in transmission--through the egg-- of sufficient virus to initiate an epizootic in the succeeding generation.

BIOTIC CONTROL RESEARCH--LODGEPOLE NEEDLE MINER

by

G. R. Struble
Pacific Southwest Forest and Range Experiment Station
U. S. Forest Service, Berkeley, California

We have considered two approaches: (1) pathogenic control by Bacillus thuringiensis Berliner (Bt), and (2) control possibilities by manipulating certain native insect parasites. Since 1962 we have greatly increased our information in both fields.

Preliminary tests demonstrated the infective capability of different Bt formulations against third- and fourth-instar host larvae. Field tests in 1963 with 90-T Bt concentrate were by backpack mistblower to 15-foot trees. Three strengths, each in triplicate, were aimed to infect first-instar larvae after eclosion. Low control results--between 40 and 45 per cent--were attributed to weather-induced hatching delays and reduced spray deposit infectivity by sun rays. Replications at different time intervals with newer Bt formulations are needed for conclusive results.

Parasitic evaluation studies revealed two categories: (1) host synchronized; and (2) nonsynchronized multiple host species with short life cycles. Discouraging controls by host-synchronized species continued after more than 15 years of outbreak infestations. However, the short life cycle and regular incidence of several eulophids, increasing during seasonal host development, suggest manipulations. Properly timed releases of mass-reared eulophids could conceivably result in rapid host reductions.

NEMATODE PARASITES OF BARK BEETLES

by

C. L. Massey

Internal nematode parasites of bark beetles belong to two superfamilies, Tylenchoidea and Aphelenchoidea. Three genera in the family Tylenchidae are of primary importance. They are Contortylenchus, Parasitylenchus and Sphaeruleriopsis. In the family Aphelenchoidae two genera, Parasitaphelenchus and Ektaphelenchus have been recovered from the abdominal cavity of various members of the Scolytid family. Associated forms recovered from bark beetle galleries are included in most families of the superfamilies Dorylaimoidea, Rhabditoida, Tylenchoidea, Aphelenchoidea, and Plectoidea.

Various workers have ascribed the following importance to nematodes in their relation to bark beetles.

(1) The killing or weakening of the beetles.

(2) The reduction of egg laying by female beetles.

(3) The prevention of a second generation the same year.

(4) The sterilization of both sexes.

Little work was done on nematodes on bark beetles in the United States until the early 1950's when it was demonstrated that female beetles of Dendroctonus obesus when infested with Contortylenchus reversus and Sphaerulariopsis dendroctoni laid fewer eggs by 45 and 62 per cent respectively than uninfested females. Egg galleries constructed by infested beetles were considerably shorter than those constructed by uninfested beetles. Infested adults in individual trees ran as high as 75 per cent. It has also been demonstrated that Contortylenchus elongatus, a parasite of Ips lecontei and Ips confusus, reduced the egg laying potential of the latter species by 50 per cent. Studies on this parasite revealed that beetle progeny were more likely to be infested when the female or both sexes were infested than when the male alone was infested.

Infections by various species of Contortylenchus and Sphaerulariopsis dendroctoni are not lethal. The effect on the host seems to be of a mechanical nature rather than pathological. The abdominal cavity of infested females become so packed with eggs and larvae of the parasite that normal egg production is greatly reduced.

The life histories of the various species of Contortylenchus are completely synchronized with their hosts. In the laboratory the parasites develop from egg to adult in a period of 20 days. In the field they may take from one month to two years depending on the life history of the host. Males of the parasites are free living and are found only in the egg and larval galleries of the host. Studies on the species of this genera disclosed that in the laboratory by a system of selection a given population of beetles could be totally infested and eventually eradicated.

Research on Parasitylenchus elongatus, a nematode parasite of the fir engraver beetle revealed the life history to be similar to that of the species Contortylenchus studied with the important difference that Parasitylenchus elongatus kills its host. Infective stage larvae are deposited in the insect gallery before death. Host larvae in adjacent galleries are infected by migratory infective stage larvae of the nema. Infested males are sterilized; infested females do not lay eggs. Galleries constructed by infested females are usually less than an inch in length. Evidence indicates that Parasitylenchus elongatus was responsible for the decline of an infestation of Scolytus ventralis in southern New Mexico. A biological evaluation of the infestation shortly preceding its termination revealed trees in which the majority of galleries were very short. Eggs had not been deposited. Duplicate conditions were produced in the laboratory by inoculating green fir logs with beetles infested with the parasite.

Much basic research on the ecology and epidemiology of the parasites is essential before their use as biological controlling agents can be forecast; their use as such offers intriguing possibilities.

It may be possible to cross inoculate a parasite species to a host species of the same genus or closely related genera with a rapid enhancement of the lethal potential of the parasite.

At present the parasites can be produced only in their host. Artificial media may be developed in which the nemas may be mass produced with subsequent introduction into bark beetle infestations.

Biological sterilization offers possibilities in nematode bark-beetle relationships. It has been demonstrated that many of the parasites sterilize their host. By proper manipulation, infested beetles may be released into bark-beetle infestations, possibly resulting in the sterilization of one or both sexes of a given beetle population.

Nematodes offer an excellent opportunity for the use in the field of integrated control. Common insecticides, such as the chlorinated hydrocarbons, have little, if any, effect on the worms when applied as water emulsions.

Use of external symptoms exhibited or produced by beetles infested with nematodes may be used in the biological evaluations of bark beetle infestations. Scolytus ventralis infestations at present can be evaluated solely by the presence or absence of short galleries commonly produced by infested females.

The challenges in the field to the ecologist and the biologist are great; the challenge to the taxonomist is even greater. A vast majority of the nematode species associated with and parasitic in and on bark beetles in the United States are undescribed. This field is particularly demanding in that in many cases it is quite difficult to associate the parasitic forms with their free-living counterparts. Free-living males often bear little resemblance to their parasitic mates. Diagnostic characteristics are, in the main, obscure or absent.

Nematology is a field in which much remains to be learned, and of which few forest entomologists have an adequate conception.

WOODPECKER-BARK BEETLE RELATIONSHIPS

by

Paul H. Baldwin
Department of Zoology
Colorado State University
Fort Collins, Colorado

In studies on predator-prey relationships of woodpeckers and bark beetles in the spruce-fir forests of the Colorado Front Range, census work has shown that near small, endemic infestations of Engelmann spruce beetle (Dendroctonus engelmanni Hopk.) the winter density of woodpeckers reaches about 0.7 birds per square mile. The character of insect food being taken by the woodpeckers under different levels of beetle density varies, and this variation is being studied in order to show the range of feeding norms. Quantitative aspects of beetle consumption are being approached through caloric measurements of food consumed by caged woodpeckers. Under mild conditions, caged Hairy Woodpeckers (Dendrocopos villosus) consumed the caloric equivalent of approximately 400 adult Engelmann spruce beetles for their daily caloric intake; however, many factors must be considered before applying such a value as this to the wild situation. In another approach, the hunting abilities of woodpeckers are being studied by measurement of their sensory capacities. The Hairy Woodpecker was found able to hear sound wave frequencies from 19,000 cycles per second down to 150 cps, or possibly lower. Its most sensitive range of hearing at low decibels fell between 750 and 1,500 cps.

An estimate was made of the extent of predation by birds on adult Black Hills beetles (Dendroctonus ponderosae Hopk.) during the flight and attack stages of the beetle. All species of birds preying on the beetle were taken into consideration. Methods involved censuses of beetles and birds as well as examination of stomach contents of birds. In one instance, where beetle density was approximately 32,000 per 10 acres, the reduction of beetle population by avian predation was calculated as 8.5 per cent.

RECENT STUDIES IN BIOLOGICAL CONTROL AT THE UNIVERSITY OF CALIFORNIA

by

Donald L. Dahlsten

There are several research programs in progress at the university that pertain to the biological control of forest insects. A number of students have contributed to the natural control aspects of R. W. Stark's study of the population dynamics of the western pine beetle, Dendroctonus brevicomis, in the Division of Entomology and Acarology. A study of Roptrocerus zylophagorum, one of the primary parasites, is nearing completion and will be submitted as a doctoral thesis by R. W. Bushing. The work on an important predator, Enoclerus lecontei, has just been submitted as a doctoral thesis by A. A. Berryman. Other investigators are studying the effects of mites, woodpeckers and nematodes on beetle populations. The Division of Biological Control is currently working on parasite distribution within the tree, parasite biologies and particular attention is being given to the incidence of hyperparasitism. Several samples have yielded a parasite, Tetrastichus thanasimi, which had not been collected previously from Enoclerus lecontei.

There are several other general studies of bark beetle parasites in California. A synoptic list of the hymenopterous parasites of the Scolytidae north of Mexico will be published some time this year in the Canadian Entomologist by R. W. Bushing. The Division of Biological Control is conducting a survey of the parasites of California Scolytidae. Other bark beetle programs currently in progress are studies of Phloeosinus spp. parasites and the parasites of Scolytus ventralis.

There are several phases to the project underway on the white-fir sawfly, Neodiprion abietis complex. A study of the parasite complexes in several different regions is being conducted. The effects of chemical insecticides on the parasite complexes is also being considered. The biology of a pentatomid predator, Podisus sp., will be studied this summer and a field test with a polyhedrosis virus will be done with L. A. Falcon of the Division of Invertebrate Pathology. With the cooperation of D. L. Wood of the Division of Entomology and Acarology and the Stanford Research Institute an attempt is being made to isolate and identify the sex pheromone.

An attempt to study the insectivorous birds of California forests is also being made. Most of the effort to date has been with the mountain chickadee, Parus gambeli, and its effect on lodgepole needle-miner populations. Nesting boxes have been used in this study to increase the number of nesting pairs in the area. Plans have been made to establish two or three additional nesting box plots in other forested regions of California with improved nesting boxes. The feeding habits of these birds is being considered as well as the effects of chemical insecticides on fecundity.

Much of the current effort is being expended on the Douglas-fir tussock moth and its parasites. Large acreages of land in the white-fir growing regions of California are infested with this insect. Study areas have been established in eight of the infestation regions. Preliminary

results indicate that there are a number of parasites as well as a polyhedrosis virus present throughout the infestation area. Three and possibly four species of egg parasites, a tachinid larval parasite, four species of ichneumonid larval or pupal parasites, and several braconids and pteromalids of questionable status have been collected to date. The tussock moth is only considered a pest periodically. Long term plans are to follow the populations of this defoliator until they crash and then to study this moth under endemic conditions.

FOREST INSECT PATHOGEN BANK

by

J. L. Bean
Regional Entomologist, U. S. Forest Service,
Upper Darby, Pa.

Three of the preceding papers nicely illustrate the role insect pathogens will play in our future forest insect control program.

The use of biological control, especially pathogens, is of special interest to us in the Northeast. Unfortunately, whenever we have considered the use of pathogenic agents we have found that only small quantities of these pathogens were available.

To solve this problem and to have a sufficient supply of a recommended and effective pathogen on hand when needed we have established a "Forest Insect Pathogen Bank". This "Bank" is located at our Southern Zone office at Harrisonburg, Virginia, and is under the direction of W. L. Freeman, our southern zone control entomologist.

The main objectives of this bank are:

1. To build up a large supply of all laboratory tested and recommended insect pathogens.

2. Pilot test these pathogens to determine field dosage rates, time of application, and duration of effectiveness in the field.

3. Maintain these pathogens in a virulent stage.

Currently, we are working with seven pathogens that have been recommended for six of our more important forest insects. The insects and pathogens concerned are:

1. Forest Tent Caterpillar - a nuclear polyhedrosis virus

2. European pine sawfly - " " " "

3. Virginia pine sawfly - " " " "

4. Linden looper - " " " "

5. Red-headed pine sawfly - " " " "

6. Fall webworm - a nuclear polyhedrosis as well as a grandulosis virus.

Our main problem now is building up large quantities of these viruses for future control use. Currently, we are working with these insects only when we can find them in outbreak conditions. In the future we hope that special rearing techniques will enable us to produce the volume of virus we need when we need it. At the present time our stockpile is limited, but we are working hard to make it a major contribution to our control programs.

We are also field testing Bacillus thuringiensis, but since it is available commercially it is not a part of our stockpile.

Your support in helping us maintain and supplement this pathogen bank is encouraged. If you know of any other pathogens that are effective against our eastern insects and that have been laboratory tested, we would appreciate knowing of them.

BIOLOGICAL CONTROL OF THE LARCH SAWFLY

by

W. J. Turnock

The parasite complex of the larch sawfly in North America is characterized by an extreme poverty in comparison with the complex in Europe. Only two parasite species are regularly recovered in this continent and the efficiency of one of these, the ichneumon Mesoleius tenthredinus Morley, has been greatly diminished by the presence of a host strain with an immunity to this parasite.

In 1958 a program was initiated to introduce new parasites into Canada. Parasite releases, which began in Manitoba in 1961 and have continued to 1964, have involved two ichneumonid and three tachinid species. Successful establishment of one ichneumon, Holocremnus sp. nr. nematorum Tschek, has been recorded at two release points. The intensive study of the population dynamics of the larch sawfly being conducted at the Winnipeg Laboratory provides information for detailed analyses of the establishment and impact of this new parasite. Adult populations of H. sp. nr. nematorum have been estimated at about 350 per acre in each of the first two years after release with an increase to about 700 per acre in the third year. In the 1961 release area parasitism reached 10 per cent of the host cocoons in 1964, while in the second area, 30 per cent parasitism was reached in 1964 following releases in 1962 and 1963. The prospects for a significant reduction in host populations seem good.

Additional releases of a Bavarian strain of M. tenthredinus were made in 1963 and 1964 following studies of J. A. Muldrew which revealed a relatively strong ability of this parasite strain to avoid or overcome the immunity reaction of North American larch sawflies. Initial results indicate some increase in the parasitism by M. tenthredinus in the release area.

WORKSHOPS

Chairman: W. F. McCambridge

CHEMICAL CONTROL OF SPRUCE BUDWORM

Moderator: D. O. Scott

Thirteen men reviewed the various facets of chemical control against the spruce budworm. Three main questions were posed and discussed.

1. What is the primary objective in spraying for spruce budworm?

   The consensus of the group appears to be--keep trees alive to prevent growth losses or until the trees can be used commercially. However, in some cases, other intangible values such as recreational or esthetic values must be considered. Occasionally pressure groups have helped influence our decision to spray some spruce budworm infestations.

   In the Northern Region, which is primarily Montana and northern Idaho, they are setting up management units where Douglas-fir stands should be protected. These may be Christmas tree areas, potential commercial pole stands, sawtimber, or areas with high recreational values. It may be necessary to spray several times before they harvest the crop, but some stands sprayed in 1956 and 1957 are still endemic.

2. How can we increase our operational efficiency on spray projects?

   With the advent of new techniques, we, as resource managers, must take another look at our present methods of spray application and spray evaluation. For example, oil sensitive spray cards have been used to determine spray distribution. In past projects, we have been lucky if these sensitized cards registered oil droplets of 50 microns. Thus, we need to know what happens to the smaller droplets that give us that familiar oil smell in canyon bottoms. You may recall the report by the Bureau of Sport Fisheries and Wildlife where Bridges and Andrews smelled oil in Swan Creek, a tributary of the Gallatin River in Montana, but no oil droplets registered on their spray cards along the stream. However, there was a sizable catch of moribund aquatic insects in their drift samples.

   We learned in our group discussion that Canada will have an air pollution engineer on their project spray team this year. We will all be interested in learning just what happens to the small spray droplets. Fluorescent dyes may be used.

   In recent projects in the United States, we have been leaving unsprayed buffer strips to protect our fisheries' resources. It is now apparent that we have been leaving too wide a strip. By using helicopters to spray these sensitive areas, one can reduce the width of buffer zones. If we take another Northern Region example, aerial detection in 1964 on

the Bitterroot National Forest showed some reinfestation from the one-fourth mile wide unsprayed buffer strips left in the 1963 spray project.

In the Region 4 or Intermountain Region spray project last year, there were about 700 miles of unsprayed buffer zones. In some cases, we may be leaving over 20 per cent of the area needing control in unsprayed zones.

3. The third point of interest to this group was what are the promising new chemicals?

Several experimental areas will be closely watched by foresters and biologists. The 160,000-acre experiment area in Canada should give us many answers on low-volume applications of malathion. However, primarily because of the difference in terrain, two small pilot tests using low volumes of malathion will be conducted in the States if they are approved by the Federal Committee on Pest Control. One will be in the Intermountain Region and the other will be in the Northern Region. Last year, in the Northern Region, a very small test with too few plots gave promising results in a pole-size stand.

Zectran, dibrom, and pyrethrum are being tested in the Berkeley, California Pesticide Laboratory. Field tests of these new chemicals on several thousand acres are being considered for 1965. If the small tests show promise, 10,000- to 20,000-acre tests will be undertaken in 1966.

BIOLOGICAL CONTROL OF BARK BEETLES

Moderator: J. W. Butcher

Workshop interests were varied; ranging through research on nematode and mite parasites of bark beetles; predation by birds; parasite efficiency, ecological genetics, and bark beetle biology and ecology. Some 19 participants were present.

Following an expression by each of personal interest in subject matter covered by the title, everyone participated in a general discussion. Initially, numerous personal experiences were recounted, dealing with specific insecticide - predator - parasite relationships. This evolved naturally into speculation on benefits that might accrue from more sophisticated employment of each agent alone, or in integrated control programs. For example, it was suggested that short-lived insecticides might kill the bark beetle yet not persist long enough to adversely affect predators hibernating in the soil. On the other hand a parasite might take a significant toll of its host, but actually result in greater economic loss by lessening intra-specific competition.

Desirable modifications and reorientation of current biological control programs include the following:

1. Chemical insecticides should not be used if they destroy an essential residue of natural control agents.

2. More consideration should be given to the possible deleterious effects of reduced intra-specific competition, which might follow introductions.

3. A critical analysis needs to be made of existing biological control knowledge. Where can parasite manipulation be recommended, and where might management practices offer a greater return?

4. Is individual research effort and problem selection too wasteful and unproductive in terms of real understanding? Should not greater effort be devoted to a team approach since complex mechanisms are involved and individual factors taken out of context may produce a result contrary to the desired objective?

5. Populations should be studied at endemic, as well as at outbreak levels.

6. Specific attitudes should be agreed upon with respect to exchange and introduction of insectivorous parasites and predators. What information should be available before such introductions are made?

7. A future work conference should seriously consider a workshop on the role of vertebrates in bark beetle control.

BIOLOGICAL CONTROL OF DEFOLIATORS

Moderator: D. C. Schmiege

This discussion was arbitrarily divided into three categories-- parasites, predators, and pathogens. The 13 members present all participated, which resulted in a very lively discussion.

Bill Turnock, Winnipeg, Manitoba, discussed their program in Canada using an introduced species of ichneumonid parasite for control of the larch sawfly. They are very hopeful that this parasite will become an effective control agent. It was also mentioned that a Bavarian strain of Mesolieus tenthredinis is not encapsulated by the larch sawfly, so this parasite should also be effective again.

Bob Denton, Missoula, Montana, briefly discussed their work with the larch casebearer. Collections of the parasite, Agathis pumila, have been made in the eastern states and have been introduced for control of the casebearer. Don Renlund, Madison, Wisconsin, said that this parasite has been responsible for a great reduction in the casebearer population in Wisconsin.

The need for parasite collections from a wide range of areas was brought out as it is likely that genetic material is important in susceptibility tests.

George Struble, Berkeley, California, reviewed the work of biological control efforts against the lodgepole needle miner. The host synchronized species of parasites seemed the most promising, but after 20 years they haven't controlled the needle miner. Some of the non host synchronized and possibly nonhost specific parasites may be manipulated for control. The question was raised--Why aren't we manipulating populations? The answer was that we aren't well enough acquainted with the biota to know what we are manipulating. This led us to a discussion of eradication. It was agreed that eradication is appealing to many people and has been responsible for large appropriations. Many of us expressed the belief that eradication of native insects, even if serious pests, may not be desirable however. In addition to destroying a portion of the food chain, eradication of a pest insect would also result in destroying the species' enemies. A subsequent introduction of the pest could be very serious.

Predation was discussed briefly. Bull Turnock stated that bird predation of larch sawfly was being studied. Of the 53 bird species studied, 43 preyed on larch sawfly. Birds may be a very important factor when insect populations are low. Spiders were briefly discussed. It was agreed that they should receive more study, but taxonomic problems have not been solved. Most spiders are difficult to identify.

Pathogens causing insect diseases were considered as the final topic. Frank Lewis, West Haven, Connecticut, briefly reviewed the work with Bacillus against the gypsy moth. The major problem is that many of the species of bacteria are not identified and pure crystals are not available. It is not possible to learn the mode of action until exotoxins, crystals, and spores are purified and separated. Lewis emphasized that B.t. should be thoroughly pretested in the laboratory for biological activity against the

target insect before going in the field. Antibiotic substances in leaves of some trees pose a problem. The gut pH of insects is also involved. If the pH is too low the crystals won't dissolve.

Milt Stelzer, Albuquerque, New Mexico, stated that the viruses used against the tent caterpillar have not been virulent enough and that some selection for virulent strains will have to be done. The effects of stress on susceptibility was discussed. This has been argued for years and is apparently not resolved yet.

Fungi were mentioned as control agents. Beauvaria bassiana was collected from black-headed budworm larvae for the first time in 1964. Don Renlund mentioned that Cordyceps sp. was important on some insect pests in Wisconsin at times.

Ian Campbell, Iowa State University, described a moribund condition found in corn borer larvae. Frank Lewis stated that a similar condition found in gypsy moth larvae was caused by oviposition or by "stings" from some parasties. Bill Turnock stated that fluctuating temperatures during diapause could cause a similar moribund condition.

Frank Lewis brought out the importance of microsporidian diseases. A protozoan is the most important pathogen of the gypsy moth in Germany.

The discussion ended at 5:30 p.m., but was continued informally on into late evening.

WORKSHOP SUMMARY

HOST RESISTANCE, SUSCEPTIBILITY AND ATTACK CHARACTERISTICS (BARK BEETLES)

Moderator: R. F. Shepherd

Eighteen participants compared the attack characteristics of a range of scolytids from the point of view of the type of material they attack (healthy trees, dying trees, slash, blowdown, etc.), the spatial distribution of attacked trees in stands and the degree of success of attacks in establishing a gallery. The reasons for these different attack characteristics were discussed including the following: the ability to detect suitable material, the ability to produce secondary attraction and concentrate the attack, the type of host material, its distribution and degree of specific attraction. The following scolytids were compared: Dendroctonus ponderosae, D. brevicomis, D. obesus, D. pseudotsugae, D. frontalis, Ips confusus, I. avulsus, Trypodendron lineatum, and Scolytus multistriatus.

A wide-ranging discussion of host resistance followed in which three different approaches to the measurement of host resistance were brought out: oleoresin pressure as measured by pressure gauges attached to holes bored into the stem, an estimate of the ability of the tissues at the cambial layer to change to a resinous condition in response to inoculation by blue stain, and a measure of the volume of resin which flows from holes drained by capillary tubes. Factors which were discussed and thought important to host resistance studies were the numbers of attacking beetles, the moisture stress in a tree, the large differences between host species and individuals within a species and between different species of attacking beetles, and a large variation in resistance both seasonally and diurnally. All participants entered into the discussion providing a stimulating and profitable workshop.

WORKSHOP ON ATTRACTION

Moderator: D. L. Wood

Discussion in this workshop centered primarily on the area of sex and food or host attractants of forest insects and therefore chemotactic behaviour seemed to be the primary concern.

The workshop agreed that the Conference might benefit from a brief summary of research on chemical attractants with particular reference to investigator, insect species and type of studies contemplated or underway, i.e. identification, biology, control, etc. This information then might form the basis for any cooperative or coordination efforts in existing or planned research.

Defoliators

(1) E. P. Merkel, U. S. Forest Service, Orlando, Florida, has established a pheromone response for Dioryctria abietella (Lepidoptera: Phycitidae). They are able to rear this insect in large numbers but no arrangements for identification have been made.

(2) J. D. Solomon and co-workers of the U. S. Forest Service, Stoneville, Mississippi have identified a pheromone response and developed a field bioassay for the carpenter worm, Prionoxystus sp. (Lepidoptera: Cossidae). Techniques are being developed for mass rearing this insect. Plans for identification are unknown.

(3) Biological studies with particular reference to flight and mating behaviour of Rhyacionia buoliana (Lepidoptera: Olethreutidae) are contemplated by G. W. Green and co-workers of the Forest Entomology and Pathology Laboratory, Sault Ste. Marie, Ontario, Canada, and by G. L. Daterman, Forestry Sciences Laboratory, U. S. Forest Service, Corvallis, Oregon.

(4) D. L. Wood, D. L. Dahlsten and R. W. Stark, University of California have begun behavioural studies on the Douglas-fir tussock moth, Hemerocampa pseudotsugata (Lepidoptera: Lymantriidae) and various species of Neodiprion sawflies (Hymenoptera: Diprionidae). Mass rearing programs are currently in progress. D. W. Henry, J. O. Rodin and R. M. Silverstein of the Stanford Research Institute have undertaken the chemistry investigations.

It was surprising to learn that no one could identify any investigators working with host and sex attractants of the spruce budworm. The Canadian entomologists in eastern North America are presently assessing the status and future direction of budworm research and will probably begin work in this area of behaviour. It was the consensus of opinion that, based on the success of the Agricultural Research Service with the gypsy moth (Porthetria dispar) sex-attractant, increased research efforts should be directed towards this end with our principal forest defoliators.

Bark Beetles

The following investigators have undertaken studies designed to identify bark beetle sex-pheromones:

Dendroctonus pseudotsugae

(1) J. A. Chapman, Forest Entomology and Pathology Laboratory, Victoria and R. H. Wright of the British Research Council, Vancouver, B. C.

(2) J. A. Rudinsky and co-workers, Oregon State University, Corvallis.

Dendroctonus frontalis

(1) R. I. Gara, Boyce Thompson Institute, Inc., Beaumont, Texas.

(2) Ching Tsao, University of Georgia, Athens.

(3) E. W. Clark, Forestry Sciences Laboratory, Durham, North Carolina.

Dendroctonus brevicomis and ponderosae

(1) D. L. Wood, University of California, Berkeley and Stanford Research Institute, Menlo Park.

Ips confusus

(1) G. B. Pitman, Boyce Thompson Institute, Inc., Grass Valley, California.

(2) University of California and Stanford Research Institute.

Scolytus multistriatus and/or quadrispinosus

Research is in progress at the University of Wisconsin under D. M. Norris but the precise objectives are unknown.

The following investigation is concerned with identification of chemicals from plant extracts which govern host plant selection: Scolytus multistriatus and the mimosa webworm. J. Peacock, U. S. Forest Service, Delaware, Ohio and D. Kosk, Department of Pharmacology, Ohio State University, Columbus.

The ensuing discussion included the following subjects and conclusions:

(1) The current work of the Agricultural Research Service on the sex attractants of the striped cucumber beetle, codling moth, pink bollworm, gypsy moth, cockroach and cotton boll weevil was reviewed by C. H. Hoffmann.

(2) All agreed that a thorough knowledge of field biology and behavior is desirable and such research can proceed independently from identification studies. This information will be absolutely essential when pure compounds are made available by the chemists.

(3) Trapping methods can be developed now using the natural materials in the field, but such methods will probably have to evolve when the highly potent, pure materials become available.

(4) Overemphasis of the chemotactic response is both natural and dangerous

during the early phases of such investigations. Everyone agreed that other attendant behavior patterns such as sound and light orientation are important and should receive attention. Several examples illustrate the importance of such work: (a) Southern pine beetle and the western pine beetle will respond only to standing trees in the presence of attractants; (b) European pine shoot moth will fly past attractive males caged in openings to trees upwind from this location. A phrase was proposed for this emphasis on total approach: "integrated attraction behavior".

(5) The use of sex-attractants to confuse as well as trap insect populations provides an intriguing possibility for control. However, the basis for such an approach remains to be established in the field. Scientists of the Agricultural Research Service have attempted such an approach with the gypsy moth in 1963 and 1964 but with little success.

(6) The selectivity of attractants was considered and placed in doubt by some recent findings:

(a) Cross-attraction between several sympatric but reproductively isolated species of Ips in California was reported.

(b) I. avulsus responds to southern pine beetle attractants in the absence of its own under low population levels.

This type of evidence suggests the possibility that two chemotactic response mechanisms are operating, i.e. something produced by and common to boring activity and a sex pheromone which is the underlying mechanism of species specificity. The response of predators to attacked trees supports such thinking.

(7) The area of research which deals with initial attraction or host plant selection is extremely difficult and is complicated experimentally by the apparent fact that all host attractants or related materials are always repellent at some higher concentration. All agreed that these investigations are extremely valuable and the success of such materials as methyl engenol, etc. in the survey and control of the Mediterranean fruit fly is adequate justification for such efforts.

(8) Mass rearing capabilities were considered to be one of the most important areas needing research attention and judged to be absolutely primary to successful identification of host and sex-attractants.

INSECT SURVEY TECHNIQUES, TRAINING AND SUPERVISION

Moderator: G. T. Silver

I. Training

Technicians are very important to the research officer. Most technicians have only two to four years high school education; therefore, they must be trained. This, in most cases, involves intensive training. The problem of training a lab technician is easy compared with training a man for field work. To train a field technician so he can operate independently in the field with a minimum of supervision takes five to eight years. As a rule the general training program has to be set up to include such things as:

A. Background and purpose of work.

B. Familiarize the technician with the forms, etc., how to fill in the forms, and the collection slips.

C. Insect identification.

D. Tree identification.

E. Use of equipment which includes microscope, power saws, outboard motors, four-wheel drives, etc.

F. Forestry background. How to lay out plots, run strips, and take standard measurements, etc.

G. Report writing -- very important.

H. Sampling methods.

I. Tree diseases such as recognition of symptoms and appraisal of conditions.

J. Biological background such as life history of insect species, importance, economics, etc.

II. Supervision

A. Make all technicians feel they are a part of the team and that their work is necessary.

B. Put all technicians in a position of trust.

C. Work out summer program. Make certain that he knows why things are done, as well as how to do them.

D. Check the work carefully. Most men like to have their work checked.

Comment -- Most technicians today are coming from ranger schools and vocational schools. One of the main problems with this is that many good students in ranger schools decide to go on to the University and become professional foresters. Nevertheless, there are still many

good men and women without University entrance qualifications who are available and make very good technicians.

III. In-service Training.

Greater use is being made of teaching machines and teaching texts designed for technicians without the necessary forestry or entomological background. This is being used in several regions with very good results.

IV. The overall terms of reference for the workshop would have required days of discussion, so in order to get to specifics it was agreed to take a very confined problem such as training aerial observers. The qualifications for aerial observers are quite tremendous. We find that among other things he must have the following qualifications:

A. He must like to fly. Color blindness could be a detriment. It may take three years to train an observer to recognize all tree species and all types of insect damage from the air, and most important to read maps.

Comments -- Way to overcome this - Don't train them as observers, train them as entomologists. The use of colored films was pointed out as one approach to the problem. This is done by taking vertical and oblique movies. Show these movies to your trainees and have them prepare maps based on these movies. These movies can also be used to teach them how to detect different tree species and different types of insect damage. Still photographs are also useful for training.

Men being trained as aerial observers should be taken into the damage areas and then flown over the same areas. In this way when they are mapping from the air they also have a mental image of what the condition is on the ground.

General Survey Techniques - Punch cards

It was noted that Jim Bean is preparing a code system which will enable him to put general survey data on IBM punch cards. This will standardize data from portions of fourteen States. Pete Orr is also doing the same for the Portland Region.

The general consensus of opinion at this point was that although the Canadian system leaves much to be desired, the methods of recording survey data are standardized from coast to coast. Frank Yasinski commented that it was time someone undertook to standardize survey data from all regions of the United States so that the information could be put on punch cards and the data for each species could be compiled for all forest regions of the United States. It was concluded that although there are regional differences there are common data such as date of collection, insect species, host tree, and locality which could be applied to all regions and still allow sufficient space for recording all local information. It was suggested that it might be possible to develop a uniform system for East and West.

The topic of survey techniques was discussed briefly. One of the

major problems is lack of standardization of survey techniques. For instance infestations are classified as light, moderate, and severe, but the classifications pertaining to these classes vary from region to region. There is also lack of uniformity of survey sampling methods. Sampling for spruce budworm is carried out using a 10-inch tip, 18-inch tip, half branch, and whole branch as the sample unit, and populations are quoted as number of egg masses per inch of twig, per 10-inch sample, per square foot of foliage surface, per 100 square feet of foliage surface, or per 1,000 square inches of foliage.

It was generally concluded that there is an urgent need for survey heads and personnel to hold a week's meeting to discuss standardization of methods and techniques.

MINUTES OF FINAL BUSINESS MEETING

March 4, 1965

The Chairman called the meeting to order at 10:00 a.m. in the Silver Room, Denver Hilton Hotel, Denver, Colorado.

1. Minutes

A.E. Landgraf moved that the minutes of the initial business meeting be adopted as read. Seconded. Carried.

2. Constitution

The report of the Constitution Committee was as follows:

From Article IV (4) delete the following:

"...to determine the amount of funds needed to finance the organization and to set appropriate registration fees or dues."

To Article V (5) add the paragraph:

"The Conference registration fee will be set by the local arrangements committee in consultation with the Secretary-Treasurer and Chairman."

It was moved by K. H. Wright and seconded by N. E. Johnson that the report be accepted. Carried.

3. Meeting Places

P. Grossenbach reported that the local group had decided that Las Vegas would be a suitable site for the 1967 meeting.

In commenting on another combined meeting of the Western and Central Conferences, W. A. Reeks said he would like to see one arranged in the future, possibly 1968 or 1969, but would discuss the matter with the members of the C.I.F.I.D.W.C. before coming to a decision.

Don Schmiege stated that a decision to hold a meeting in Juneau, Alaska, would probably affect attendance. A more suitable time of year to hold a meeting in Juneau would be in the fall, if that were possible.

4. Program Format

In discussing the program the following points were made:

(a) Workshops should be staggered to allow fuller participation.

(b) They should be allowed more time - 1/2 day was suggested.

(c) The titles should not be too broad.

(d) Maximum numbers in attendance at one workshop should be kept to 12 - 13 people. If more are interested, have additional sections of each workshop.

(e) It was suggested that the four-day meeting was longer than necessary, that we should adhere more closely to the work being done within our group and give more time for discussion.

(f) G. T. Silver reported that K. H. Wright and A. E. Landgraf have agreed to assist with the technical program. A suggested theme is "Climate and Insects".

(g) As chairman of the local arrangements committee for 1966, E.D.A. Dyer reported that probably some of the time would be spent in the new laboratory at Victoria, but because of transportation difficulties most would be spent at the convention hotel.

5. Society of American Foresters

So few members had filled out forms that Stark had no report to make regarding an Entomology Division.

6. Nominating Committee

The Nominating Committee selected Dr. Bob Stevens to replace R. F. Shepherd as Councilor. There were no nominations from the floor.

7. Translations Committee

The report was read by M. M. Furniss.

After some discussion on the work of the Committee it was moved by K. H. Wright that the committee be discharged with thanks for a job well done. Seconded by D. Schmiege. Carried.

8. Common Names Committee

Following the report of the Common Names Committee there was considerable discussion. It was suggested that controversies such as that caused by the Dendroctonus revision made it difficult for the committee to function freely. However it was felt there was sufficient work to justify keeping the committee active. The report was formally accepted by the group.

9. Ethical Practices Committee

The report was given by Chairman D. L. Dahlsten. J. L. Bean of the Northeast received an award. C. J. DeMars was nominated for chairman of the local committee.

K. H. Wright reminded the group of the 1966 meeting of the Entomological Society of America to be held in Portland. R. L. Furniss is Program Chairman and would welcome Forest Entomology contributions.

D. Schmiege, as chairman of a symposium to be held in Juneau on problems associated with spray residues, welcomed any who could attend.

C. H. Hoffman thanked the group on behalf of himself and R. C. Bushland for the opportunity to attend the meeting. P. A. Godwin concurred and expressed appreciation on behalf of the Southern Conference.

A resolution submitted by S. Weitzman, Chairman of the C.I.F.I.D.C. on behalf of the Central group, expressed appreciation for the opportunity to meet jointly with the W.F.I.W.C.

J. M. Kinghorn expressed appreciation to A. E. Landgraf for local arrangements, N. D. Wygant for the program and to all those who assisted in other ways.

The meeting adjourned at 11:45 a.m.

Weyerhaeuser Research Center
P.O Box 420 Centralia Wash.
98531

Allen Dr George A
Johnson Dr. Normand
Lowenbach, Paul G

MEMBERSHIP ROSTER

WESTERN FOREST INSECT WORK CONFERENCE

Note: Active members registered at the Conference in Denver, Colorado, March 1-4, 1965, are indicated by an asterisk.

A. WESTERN MEMBERS

ALLEN, DR. GEORGE A.
(Director)
Weyerhaeuser Research Center
P. O. Box 420
Centralia, Washington 98531

*AMEN, CLARK R.
American Cyanamid Co.
1445-14th Place
Corvallis, Oregon 97330

ATKINS, M. D.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B.C.

AVERELL, J. L.
(Forester)
U. S. Forest Service
630 Sansome Street
San Francisco, California 94111

*BAILEY, WILMER F.
(Forester)
U. S. Forest Service
13429 W. 23rd Place
Golden, Colorado 80401

*BALDWIN, PAUL H. (DR.)
(Zoology Professor)
Colorado State University
Fort Collins, Colorado 80521

BARR, DR. W. F.
(Professor)
University of Idaho
Moscow, Idaho

BEDARD, DR. W. D.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P.O. Box 245
Berkeley, California 94701

*BERRYMAN, DR. ALAN A.
(Assistant Professor)
Department of Entomology
Washington State University
Pullman, Washington

*BLOMSTROM, ROY N.
(Forester)
U. S. Forest Service R-5
7847 Eureka
El Cerrito, California

BORDEN, TOM B.
(State Forester)
Colorado State Forest Service
Colorado State University
Fort Collins, Colorado

*BORG, THOMAS K.
(Student)
121 E. Lake
Fort Collins, Colorado

*BRIGHT, DONALD E. JR.
(Student)
University of California, Berkeley
259 Wilson Street
Albany, California

BRIX, DR. HOLGER
(Plant Physiologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B.C.

*BROWN, C. E.
(Entomologist)
Department of Forestry
102-11th Avenue East
Calgary, Alberta

BUFFAM, P. E.
(Entomologist) Rocky Mtn F+RES
~~Pacific Southwest Forest and Range Experiment Station~~
~~P.O. Box 245~~ P.O. Box 523
~~Berkeley, California~~ Albuquerque, N. Mex.
(Change? to New Mex)

BUSHING, R. W.
(Laboratory-Technician)
Dept. of Entomology and Parasitology
Agriculture Hall
University of California
Berkeley 4, California

*CAHILL, DONALD B.
(Entomologist)
U. S. Forest Service
Missoula Equipment Development Center
Missoula, Montana 59801

CAROLIN, V. M. JR.
(Entomologist)
Pacific Northwest Forest and Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

*CARPENTER, G. P.
(Research Representative)
Geigy Ag. Chem.
916 Deborah Dr.
Loveland, Colorado 80537

CEREZKE, DR. HERBERT F.
(Entomologist)
Department of Forestry
102-11th Avenue, East
Calgary, Alberta

CHAMBERLIN, DR. W. J.
3320 Chintimini Avenue
Corvallis, Oregon 97113

CHANSLER, JOHN F.
(Entomologist)
Rocky Mountain Forest and Range Experiment Station
P. O. Box 523
Albuquerque, New Mexico

CHAPMAN, DR. JOHN A.
(Entomologist)
Department of Forestry
506 W. Burnside Road
Victoria, B.C.

COLE, WALTER E.
(Entomologist)
Intermountain Forest and Range Experiment Station
Forest Service Building
Ogden, Utah 84403

CONDRASHOFF, SERGEI F.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B.C.

CORNELIUS, ROYCE O.
(Managing Forester)
Weyerhaeuser Company
Tacoma Building
Tacoma 1, Washington 98401

COULTER, WILLIAM K.
(Entomologist)
Pacific Northwest Forest and Range Experiment Station
P.O. Box 3141
Portland, Oregon 97208

*COX, ROYCE G.
(Forester)
Potlatch Forests Inc.
Lewiston, Idaho. 83501

*CROSBY, DAVID
(Entomologist)
U. S. Forest Service
Box 1631
Juneau, Alaska 99801

*DAHLSTEN, DR. D. L.
(Entomologist)
Div. of Biological Control
University of California
1050 San Pablo Ave
Albany 6, California 94706

DAVIS, DR. DONALD A.
(Associate Professor)
Dept. of Zoology & Entomology
Utah State University
Logan, Utah

*DeMARS, C. J.
(Entomologist)
Pacific Southwest Forest and Range Experiment Station
P.O. Box 245
Berkeley, California 94701

*DENTON, ROBERT E.
(Entomologist)
Intermountain Forest and Range
Experiment Station
Forest Service Building
Missoula, Montana 59801

DOLPH, ROBERT E., JR.
(Entomologist)
U. S. Forest Service
P. O. Box 3623
Portland, Oregon 97208

*DOTTA, DANIEL D.
(Forester)
California Div. of Forestry
State Office Bldg. No. 1
Room 354
Sacramento 14, California

DOWNING, GEORGE L.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*DYER, E. D. A.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

EBELL, DR. LORNE F.
(Plant Physiologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

EDWARDS, DR. D. K.
(Entomologist)
Forest Research Laboratory
Department of Forestry
506 W. Burnside Road
Victoria, B.C.

EVANS, D.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B.C.

FELLIN, DAVID G.
(Entomologist)
Intermountain Forest and Range
Experiment Station
Forest Service Building
Missoula, Montana 59801

FINK, CLIFFORD R.
(Forester)
U. S. Forest Service
P. O. Box 3623
Portland, Oregon 97208

*FISHER, ROBERT A.
(Product Manager)
Bioferm Div. I.M.C.
Bin B.
Wasco, California 93280

FLESCHNER, DR. C. A.
Dept. of Biological Control
University of California
Riverside, California 92507

*FURNISS, MALCOLM M.
(Entomologist)
Intermountain Forest and Range
Experiment Station
Forestry Sciences Laboratory
P. O. Box 469
Moscow, Idaho 83843

FURNISS, R. L.
(Chief)
Div. of Forest Insect Research
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

*GERMAIN, CHARLES J.
221 Forestry Building
CSU, Fort Collins
Colorado, 80521

*GOYER, RICHARD A.
College of Forestry
University of Idaho
Moscow, Idaho

GRAHAM, DR. KENNETH
(Prof. of Forest Entomology)
Department of Zoology
Biological Sciences Building
University of British Columbia
Vancouver 8, B.C.

*GRAMBO, ERNEST J.
(Assistant Regional Forester)
U. S. Forest Service
Denver Federal Center
Denver, Colorado

*GROSSENBACH, PAUL A.
(Forester)
U. S. Forest Service
Forest Service Building
Ogden, Utah 84403

GUY, W. C.
(Photographer)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

Harling CS Forest Resrch Lab Victoria,

*HALL, DR. RALPH C.
(Consulting Forest
Entomologist)
72 Davis Road
Orinda, Calif. 94563

Hard John S USFS Juneau Alaska

HARRIS, DR. JOHN W. E.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road,
Victoria, B. C.

HARTMAN, HOMER J.
(Forester)
U. S. Forest Service
Federal Building
Missoula, Montana 59801

*HEDLIN, A. F.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road,
Victoria, B.C.

HEIKKENEN, DR. HERMAN J.
(Professor of Forest Entomology)
University of Washington
Seattle, Washington 98105

*HESTER, D. A.
(Forester)
U. S. Forest Service
Denver Federal Center, Bldg. 85
Denver, Colorado 80225

Herbert Haglund 97209
Forestry Staff leader
P.O Box 3861 Portland, Ore

*HINTON, GEORGE C.
U. S. Forest Service
12359 W. Alabama Place
Denver, Colorado 80228

HOCKING, DR. BRIAN
(Head)
Dept. of Entomology
University of Alberta
Edmonton, Alberta

*HOFFMAN, DONALD M.
(Associate Wildlife Biologist)
Dept. of Game, Fish & Parks
Box 307
LaVita, Colorado 81055

HOPPING, GEORGE R.
Department of Forestry
Forest Research Laboratory
102-11th Avenue East
Calgary, Alberta

House, Gordon M Ent Dept OSU Corvallis, Ore.

*HOWARD, BENTON
(Forester)
U. S. Forest Service
P. O. Box 3623
Portland, Oregon 97208

JAENICKE, A. J.
2941 Mulkey Street
Corvallis, Oregon 97330

*JOHNSEY, RICHARD L.
Washington State Dept. of
Natural Resources
~~309 Honeyman Avenue~~ Rt.4 Box 424B
Olympia, Washington 98501

*JOHNSON, DR. N. E.
(Entomologist)
Weyerhaeuser Research Center
P. O. Box 420
Centralia, Washington 98531

JOHNSON, PHILIP C.
(Entomologist)
Intermountain Forest and Range
Experiment Station
Federal Building
Missoula, Montana 59801

KEEN, F. P.
1054 Oak Hill Road
Lafayette, California

Kimmins, J.P 1734 Delaware St.
Berkeley 3 94703

*KINGHORN, J. M.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*KINN, DONALD N.
(Student)
University of California
Department of Entomology
1038 9th Street
Albany, California 97710

*KINZER, HENRY G.
(Entomologist)
New Mexico State University
University Park,
New Mexico 88070

Kline LeRoy Oregon State Dept of For Salem Ore.

KNOPF, JERRY A. E.
(Entomologist)
U. S. Forest Service
3320 Americana Terrace
Boise, Idaho 83706

KNOWLTON, DR. GEORGE F.
(Professor of Entomology)
Utah State University
Logan, Utah

KOERBER, T. W.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*KOPLIN, JAMES R.
(Student)
Colorado State University
709 S. Washington
Fort Collins, Colorado

*LAMPI, ESLIE H.
(Forester)
National Park Service
1953 Kiva Road
Santa Fe, New Mexico 87501

*LANDGRAF, AMEL E., JR. ?
(Forester)
U. S. Forest Service
Denver Federal Center, Bldg. 85
Denver, Colorado 80225

U.S. Forest Service
50 Seventh St., N.E.
Atlanta, Ga. 30323

*LANIER, GERRY
(Student)
Dept. of Entomology and
Parasitology
University of California
Berkeley, California 94704

LARA, ING. RAUL RODRIQUEZ
Seccion Entomologia
Instituto Nacional de
Investigacionea Forestales
Progresso No. 5
Coyaocan, D. F., Mexico

*LARSEN, ALBERT T.
(Director)
Insect and Disease Control
State Dept. of Forestry
P. O. Box 2289
Salem, Oregon 97310

LAUCK, DR. DAVID R.
(Associate Professor)
Humboldt State College
Arcata, California

*LAUTERBACH, PAUL G.
(Research Forester)
Weyerhaeuser Research Center
P. O. Box 420
Centralia, Washington 98531

LEJEUNE, R. R.
(Regional Director)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*LEMBRIGHT, HAROLD W.
(Agriculturist)
Dow Chemical Co.
350 Sansome Street
San Francisco, California 94106

*LISTER, KENDALL
U. S. Forest Service
509 Kiesel Building
Ogden, Utah 84403

LOWRY, DR. W. P.
Dept. of Statistics
School of Science
Oregon State University
Corvallis, Oregon 97331

James H Lowe Jr
School of Forestry, U of M
Missoula, Montana 59801

LUCHT, DONALD
Federal Building
517 Gold Ave., S. W.
Albuquerque,
New Mexico 87101

Luck, Robert F. Calif Berkeley Calif

LYON, DR. R. L.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*MAHONEY, JOHN
(Chief Forester)
National Park Service, R-4
180 New Montgomery Street
San Francisco, California 94105

MANIS, DR. H. C.
(Head)
Dept. of Entomology
University of Idaho
Moscow, Idaho

MARSHALL, KNOX
Western Pine Association
1100 Tenth Avenue
Sacramento 18, California 95814

Mason, Richard R. For Sci Lab 3200 Jefferson Corvallis, Ore.

*MASSEY, DR. CALVIN L.
(Entomologist)
Rocky Mountain Forest and Range
Experiment Station
P. O. Box 523
Albuquerque, New Mexico

MATHERS, W. G.
(Administrative Officer) Retired
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*McCAMBRIDGE, W. F.
(Entomologist)
Rocky Mountain Forest and Range
Experiment Station
Colorado State University
221 Forestry Building
Fort Collins, Colorado 80521

McCOMB, DAVID
(Entomologist)
U. S. Forest Service
P. O. Box 3141
Portland, Oregon 97208

McGREGOR, M. D.
(Entomologist)
U. S. Forest Service
Forest Service Building
Ogden, Utah 84403

McKINNON, F. S.
(Chief Forester)
B. C. Forest Service
Parliament Buildings
Victoria, B.C.

*McKNIGHT, MELVIN E.
(Entomologist)
Rocky Mountain Forest and Range
Experiment Station
Colorado State University
221 Forestry Building
Fort Collins, Colorado 80521

McMULLEN, DR. L. H.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*MESO, STANLEY W., JR.
(Forester)
U. S. Forest Service
Denver Federal Center, Bld. 85
Denver, Colorado 80225

MITCHELL, DR. RUSSEL G.
(Entomologist)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

MOGREN, DR. E. W.
(Associate Professor)
College of Forestry and
Range Management
Colorado State University
Fort Collins, Colorado

Moffet Ole-22th Ave Ent. Dept. OSC Corvallis Ore.

*MOORE, DR. A. D.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

Molnar, Alex C Forest Research Lab Victoria

MORRIS, DR. O. N.
(Insect Pathologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road,
Victoria, B. C.

NAGEL, ROY H.
(Entomologist)
Rocky Mountain Forest and Range
Experiment Station
Colorado State University
221 Forestry Building
Fort Collins, Colorado 80521

*NAGEL, DR. W. P.
(Associate Professor)
Dept. of Entomology
Oregon State University
Corvallis, Oregon 97331

NORIEGA, ING. HUMBERTO MORENO
Jefe del Dpto. de Sanidad
Forestal
Direccion de Proteccion
Forestal
Aquiles Serdan 28
Tercer Piso
Mexico 4, D. F.

*ORR, P. W.
(Entomologist)
U. S. Forest Service
P. O. Box 3623
Portland, Oregon 97208

*OTVAS, IMRE
(Student)
Dept. of Entomology and
Parasitology
University of California
Berkeley, California 94704

PARKER, D. E.
(Chief)
Div. of Forest Insect Research
Intermountain Forest and
Range Experiment Station
Forest Service Building
Ogden, Utah 84403

PEARSON, ERNEST
(Forester)
State Dept. of Forestry
P. O. Box 2289
Salem, Oregon 97310

PETTINGER, LEON F.
(Entomologist)
U. S. Forest Service
P. O. Box 3623
Portland, Oregon 97208

*PIERCE, D. A.
(Entomologist)
U. S. Forest Service
Federal Building
517 Gold Ave., S. W.
Albuquerque, New Mexico

*PIERCE, J. R.
(Entomologist)
U. S. Forest Service
630 Sansome Street
San Francisco, California 94111

*PILLMORE, RICHARD E.
(Research Biologist)
Bureau of Sport Fisheries and
Wildlife
Denver Federal Center, Bldg. 45
Denver, Colorado 80225

*PITMAN, GARY B.
(Entomologist)
Boyce Thompson Institute
P. O. Box 1119
Grass Valley, California

Powell, John M. Canada Dept. of Forestry Calgary

*REID, ROBERT WILLIAM
(Entomologist)
Department of Forestry
102 - 11th Avenue E.
Calgary, Alberta

RICHMOND, H. A.
(Consulting Forest
Entomologist)
Lofthouse Road
R. R. # 2
Nanaimo, B. C.

RITCHER, DR. PAUL O.
(Head)
Dept. of Entomology
Oregon State University
Corvallis, Oregon 97331

ROBINS, JACK
(Ranger Supervisor)
Dept. of Forestry
Forest Research Laboratory
102 - 11th Avenue E.
Calgary, Alberta

ROETTGERING, BRUCE
(Entomologist)
U. S. Forest Service
Box 1631
Juneau, Alaska 99801

ROSE, W. E.
(Entomologist)
Northern Forest Experiment Station
Box 740
Juneau, Alaska 99801

ROSS, DR. D. A.
(Officer-in-Charge)
Forest Entomology Laboratory
Department of Forestry
Box 1030
Vernon, B. C.

RUBIO, SENOR FRANCISCO FERNANDEZ
Montrose Mexicana, S. A.
Ave. Madero No. 2-4, Piso
Postal 2124
Mexico 1, D. F.

*RUDINSKY, DR. JULIUS A.
(Professor)
Dept. of Entomology
Oregon State University
Corvallis, Oregon 97331

RYAN, DR. ROGER
(Entomologist)
Pacific Northwest Forest and Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

Safranyik, Les Forest Research Lab 721 Public Bld Calgary

SARTWELL, CHARLES, JR.
(Entomologist)
Pacific Northwest Forest and Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

*SCHAEFER, DR. C. H.
Shell Development Co.
P. O. Box 3011
Modesto, California

*SCHENK, DR. JOHN A.
(Associate Professor)
University of Idaho
Moscow, Idaho

SCHMIDT, FRED H.
(Entomologist)
Pacific Northwest Forest and Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

*SCHMIEGE, DR. DONALD E.
(Entomologist)
Northern Forest Experiment Station
Box 740
Juneau, Alaska 99801

SCHMITZ, RICHARD F.
(Entomologist)
Intermountain Forest and Range Experiment Station
Forest Service Building
Missoula, Montana 59801

*SCHMUNK, OSCAR H.
(Assistant State Forester)
Colorado State Forest Service
Colorado State University
Fort Collins, Colorado

*SCOTT, DAVID O.
(Forester)
U. S. Forest Service
Federal Building
Missoula, Montana 59801

SHEN Samuel K Dept. of Ent. WSU Pullman Wa

*SHEPHERD, DR. ROY F.
(Entomologist)
Department of Forestry
Forest Research Laboratory
102 - 11th Avenue, East
Calgary, Alberta

*SILVER, DR. G. T.
Associate Regional Director
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

SMITH, D. N.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*SMITH, ROBERT J.
(Forester)
National Park Service
P. O. Box 728
Santa Fe, New Mexico 87501

SMITH, DR. RICHARD H.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

SPILSBURY, R. H.
(Forester-in-Charge)
Research Division
B. C. Forest Service
Victoria, B. C.

*STARK, DR. R. W.
(Associate Professor)
Dept. of Entomology and
Parasitology
University of California
Berkeley 4, California

*STELZER, MILTON J.
(Entomologist)
Rocky Mountain Forest and
Range Experiment Station
P. O. Box 523
Albuquerque, New Mexico

STEVENS, DR. ROBERT E.
(Chief)
Div. of Forest Insect Research
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

STEVENSON, R. E.
(Entomologist)
Forest Research Laboratory
Department of Forestry
102 - 11th Avenue, East
Calgary, Alberta

*STEWART, JAMES L.
U. S. Forest Service
Denver Federal Center
Denver, Colorado

*STRUBLE, G. R.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

STURGEON, DR. E. E.
Division of Natural Resources
Humboldt State College
Arcata, California

SWAIN, K. M.
(Entomologist)
c/o San Bernadino National For.
P. O. Box 112
San Bernardino, California 92401

Taylor Karl B - 1706 ½ Opal St Pullman 99163

TELFORD, DR. HORACE S.
(Chairman)
Dept. of Entomology
Washington State University
Pullman, Washington

TERRELL, TOM T.
(Entomologist)
U. S. Forest Service
Federal Building
Missoula, Montana 59801

*THATCHER, DR. T. O.
(Professor)
Dept. of Entomology
Colorado State U.
Fort Collins, Colorado

THOMAS, DR. G. P.
(Regional Director)
Forest Research Laboratory
Department of Forestry
102 - 11th Avenue, East
Calgary, Alberta

THOMPSON, DR. C. G.
(Entomologist)
Pacific Northwest Forest and
Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

THOMPSON, HUGH E.
Dept. of Entomology
Kansas State University
Manhattan, Kansas 66502

Tripp, Howard A
Canada Dept Forestry
Calgary B.C.

Box 524 Route 3
Fort Collins Colorado
80521

*TROSTLE, GALEN C.
(Entomologist)
U. S. Forest Service
~~Forest Service Building~~ Federal Building
Ogden, Utah 84403

*TUNNOCK, SCOTT
(Entomologist)
U. S. Forest Service
Federal Building
Missoula, Montana 59801

Turner J.A c/o BC Forest Service Victoria

WASHBURN, RICHARD I.
(Entomologist) I.F.&E.S.
U. ~~S. Forest Service~~ Forest Sciences Lab.
~~Forest Service Building~~ P.O. Box 4169
Ogden, ~~Utah 84403~~ Moscow, Idaho 83843

WEAR, J. F.
(Research Forester)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

WELLINGTON, DR. W. G.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

WERNER, DR. F. C.
Dept. of Entomology
University of Arizona
Tucson, Arizona 85721

WERNER, DR. RICHARD A.
(Entomologist)
Northern Forest Experiment
Station
Box 740
Juneau, Alaska 99801

WICKMAN, BOYD E.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*WILFORD, DR. B. H.
(Entomologist)
Rocky Mountain Forest and Range
Experiment Station
Colorado State University
221 Forestry Building
Fort Collins, Colorado 80521

*WILLIAMS, DR. CARROLL B., JR.
(Research Forester)
Pacific Southwest Forest and Range
Experiment Station
P. O. Box 245
Berkeley, California 94701

WITTIG, DR. GERTRAUDE C.
(Microbiologist)
Pacific Northwest Forest and
Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

*WOOD, DR. D. L.
(Entomologist)
Dept. of Entomology and
Parasitology
University of California
Berkeley 4, California

*WRIGHT, KENNETH H.
(Entomologist)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

*WYGANT, DR. NOEL D.
(Chief)
Div. of Forest Insect Research
Rocky Mountain Forest and Range
Experiment Station
Colorado State University
221 Forestry Building
Fort Collins, Colorado 80521

*YASINSKI, F. M.
(Entomologist)
U. S. Forest Service
Federal Building
517 Gold Ave., S. W.
Albuquerque, New Mexico

? Zingg John G.
1332 Harrison Ave
Centralia Wn. 98531

B. MEMBERS FROM OTHER REGIONS

ASHRAFF, M. A.
(Technical Supervisor)
Green Cross Products
110 Sutherland Ave.
Winnipeg, Manitoba

BAKER, W. L.
(Assistant Director)
Div. of Forest Insect Research
U. S. Forest Service
Washington, D. C. 20250

*BASKIN, DAVID A.
Velsicol Chemical Corp.
330 E. Grand Ave.
Chicago, Illinois 60611

BEAL, DR. J. A.
(Director)
Div. of Forest Insect Research
U. S. Forest Service
Washington, D. C. 20250

*BEAN, JAMES L.
(Regional Entomologist)
U. S. Forest Service
6816 Market St.
Upper Darby, Pennsylvania 19082

BENEDICT, W. V.
(Director)
Div. of Forest Pest Control
U. S. Forest Service
Washington, D. C. 20250

*BONGBERG, J. W.
(Chief)
Br. of Forest Insect Surveys
U. S. Forest Service
Washington, D. C. 20250

*BUSHLAND, RAYMOND C.
(Lab. Director)
U. S. D. A., A. R. S.
Entomology Research Division
Metabolism and Radiation Laboratory
Fargo, N. D. 58102

*BUTCHER, JAMES W.
(Professor)
Michigan State University
East Lansing, Michigan

*CAMPBELL, IAN M.
Iowa State University
2711 Northwood
Ames, Iowa 50010

CARLSON, S. T.
(Chief)
Br. of Park Forest and Wildlife Protection
National Park Service
Room 244, Interior Building
Washington 25, D. C.

*COSTER, JACK E.
(Forester)
U. S. Bureau of Land Management
249 No. Wolcott
Casper, Wyoming 82601

*COTTRELL, HERBERT C.
(Assistant State Forester)
Wyoming Forestry Division 113
Capitol Building
Cheyenne, Wyoming

COYNE, JACK
(Entomologist)
Southern Forest Experiment Stn.
P. O. Box 122
Gulfport, Mississippi 39503

*DICKISON, FRED F.
(Forester)
U. S. D. A.
National Park Service
Midwest Region
1709 Jackson Street
Omaha, Nebraska 68102

*DONLEY, DAVID E.
(Project Leader)
Forest Insect Laboratory
287 W. Hoffner Street
Delanne, Ohio
Delaware 43015

*FETTES, DR. J. J.
(Director)
Chemical Control Research Institute
Department of Forestry
Central Experimental Farm
K. W. Neatby Building
Ottawa, Ontario

*FLINCK, PAUL R.
(Entomologist)
Forestry Section
Conservation Department
1110 Morris Avenue
Lansing, Michigan 48917

*GARA, ROBERT I.
(Entomologist)
Boyce Thompson Institute
P. O. Box 2489
Beaumont, Texas 77704

*GODWIN, PAUL A.
U. S. D. A. Forest Service
135 Wood Street
West Haven, Connecticut

*GRAY, DAVID E.
Canada Department of Forestry
Motor Building
238 Sparks Street,
Ottawa, Ontario

*GREEN, DR. GEORGE W.
(Entomologist)
Canada Dept. of Forestry
Forest Insect Laboratory
P. O. Box 490
Sault Ste. Marie, Ontario

*HARRISON, ROBERT P.
(Entomologist)
Dow Chemical Co.
Box 512
Midland, Michigan 48640

*HOFFMAN, DR. CLARENCE H.
(Associate Director)
U. S. Department of Agriculture
Entomology Research Division
Plant Industry Station
Beltsville, Md. 20705

*JOHNSON, CARL E.
(State Forester)
State of Wyoming
Capital Building
Cheyenne, Wyoming

*KIRBY, CALVIN S.
(Entomologist)
Canada Department of Forestry
114 Ruggles Avenue
Richmond Hill, Ontario

*KNIGHT, DR. FRED B.
(Associate Professor)
School of Natural Resources
Department of Forestry
University of Michigan
Ann Arbor, Michigan

*LEWIS, FRANKLIN B.
(Insect Pathologist)
U. S. Forest Service
Northeastern Forest Experimental
Station
135 Wood Street
West Haven, Conn.

*MASON, RICHARD R.
(Research Forester)
Bowaters Southern Paper Corp.
Calhoun, Tenn. 37307

*McCLANAHAN, W. DEAN
(Forester)
Br. of Park Forest and Wild-
life Protection
National Park Service
Washington 25, D. C.

McGUGAN, DR. B. M.
(Director of Program Coordination)
Department of Forestry
Room 226, Motor Building
238 Sparks Street
Ottawa, Ontario.

*MERKEL, E. P.
(Entomologist)
Southern Forest Experiment Stn.
P. O. Box 3
Olustee, Florida 32072

*MILLER, WILLIAM E.
(Insect Ecologist)
Lake States Forest Exp. Station
University of Minnesota
St. Paul, Minnesota

*MOORE, LEONARD H.
(Entomologist)
U. S. Forest Service
P. O. Box 245
Berkeley, California

*PARKER, LANSING A.
(Associate Director)
Bureau of Sport Fisheries & Wildlife
4819 N. 24th Road
Arlington, Virginia 22207

PREBBLE, DR. M. L.
(Assistant Deputy Minister Forestry)
Department of Forestry
Victoria Building
140 Wellington St.
Ottawa, Ontario

*REEKS, WILFRID A.
(Program Coordinator - Entomology)
Canada Dept. of Forestry
Motor Building
238 Sparks Street
Ottawa, Ontario

*RENLUND, DONALD W.
(Supervisor Forest Pest Survival and Control)
Wisconsin Conservation Dept.
Forest Entomology
Route 2
Nevin Hatchery
Madison, Wisconsin 53713

*ROSE, ARTHUR H.
(Entomologist)
Forest Insect Laboratory
P. O. Box 490
Sault Ste. Marie, Ontario

*SCHUDER, DONALD L.
Purdue University
2319 Sycamore Lane
W. Lafayette, Indiana

*SIMEONE, DR. JOHN B.
(Chairman)
Dept. of Forest Entomology
New York State College of Forestry
Syracuse, New York 13210

*STEHR, DR. G. W. K.
(Entomologist)
Forest Insect Laboratory
Dept. of Forestry
Box 490
Sault Ste. Marie, Ontario

Sullivan, C.R. For. Insect Lab Sault Ste. Marie

THATCHER, ROBERT C.
(Entomologist)
Southern Forest Experiment Stn.
c/o Stephen F. Austin College
P. O. Box 345
Nacogdoches, Texas 75962

*THOMAS, BOYD
(Entomologist)
Canada Dept. of Forestry
P. O. Box 490
Sault Ste. Marie, Ontario

*TURNOCK, DR. WILLIAM J.
(Entomologist)
Canada Dept. of Forestry
Forest Research Laboratory
Box 6300
Winnipeg 1, Man.

*VALCARCE, ARLAND C.
(Entomologist)
U. S. Forest Service ~~R-9~~
~~501 N. Jackson~~ St. Anthony
~~Harrisburg, Illinois~~ Idaho

*VANDENBURG, DALE O.
(Regional Entomologist)
U. S. Forest Service
17718 W. Rogers
New Berlin, Wisconsin 53151

*WALLNER, WILLIAM E.
(Asst. Professor)
Michigan State University
5004 Park Lake Road
East Lansing, Michigan

*WEBB, DR. FRANK E.
Associate Regional Director
Canada Dept. of Forestry
Forest Research Laboratory
College Hill
Fredericton, New Brunswick

*WEITZMAN, SIDNEY
(Division Chief)
U. S. Forest Service
Lake States Forest Experiment Stn.
St. Paul Campus, Univ. of Minn.
St. Paul 1, Minnesota

WHITESIDE, J. M.
(Assistant Director)
Div. of Forest Pest Control
U. S. Forest Service
Washington, D. C. 20250

*WRICH, M. J.
(Entomologist)
Chemagro Corp.
722 W. 6th Street
Sioux Falls, South Dakota 57104

ANNUAL REPORT

Committee On Common Names of Western Forest Insects

Prepared prior to 16th Western Forest Insect Work Conference

Joint Conference Sponsorship

Shortly before the 15th Conference at Banff, the Committee Chairman corresponded with chairmen of several regional forest insect work conferences in the U. S. to ascertain the possible interest of these groups in joining with the Western Forest Insect Work Conference for the purpose of (1) jointly sponsoring forest insect common name proposals for the approval by the Entomological Society of America, (2) gaining permanent membership of a forest entomologist on ESA's common names committee, and (3) exploring possible changes in the procedures of the ESA committee which would grant approval of common names sponsored by one or more of the several regional forest insect work conferences.

Replies were received from the following conference chairmen:

Dr. Lloyd O. Warren, Southern Forest Insect Work Conference, Fayetteville, Arkansas

Mr. E. B. Walker, Northeastern Forest Pest Council, Harrisburg, Pennsylvania

Dr. Sidney Weitzman, General Program Chairman, Lake States Forest Insect Work Conference, St. Paul, Minnesota.

Although the replies were the personal views of the chairmen, they indicated favorable interest in the above joint-action proposals. There appears to be a good basis, therefore, for proceeding toward a more formalized agreement between WFIWC and the several conferences in support of common name proposals for forest insects.

Committee Membership

Mr. Donald A. Pierce, Albuquerque, New Mexico and Dr. Donald C. Schmiege, Juneau, Alaska accepted appointment to the Committee to replace Mr. Valentine M. Carolin, Portland, Oregon and Dr. Norman E. Johnson, Centralia, Washington whose terms expired in 1964. Terms of the two new appointees will expire in 1969.

Common Names of Dendroctonus species

The consensus of the conferees at the 15th Conference in Banff was that there was no alternative to acceptance of the recent revision of the genus Dendroctonus by Dr. Stephen L. Wood. Because of synonymies created by the revision, ESA-approved common names for some former species appear redundant and others less apropos. In an effort to resolve some of the confusion, the Committee voted in November, 1964, for the following actions subsequently endorsed by the Conference Executive:

1. That the Committee encourage the proposal of more meaningful common names for Dendroctonus obesus (Mannerheim) and D. ponderosae Hopkins.

2. That WFIWC request the ESA common names committee to delete presently approved common names for the following species now in synonymy by reason of the Wood revision:

Arizona pine beetle	for Dendroctonus arizonicus Hopkins
Southwestern pine beetle	D. barberi Hopkins
Alaska spruce beetle	D. borealis Hopkins
Roundheaded pine beetle	D. convexifrons Hopkins
Engelmann spruce beetle	D. engelmanni Hopkins
Jeffrey pine beetle	D. jeffreyi Hopkins
Smaller Mexican pine beetle	D. mexicanus Hopkins
Mountain pine beetle	D. monticolae Hopkins
Eastern spruce beetle	D. piceaperda Hopkins
Red-winged pine beetle	D. rufipennis (Kirby)

3. That WFIWC request the ESA common names committee to delete the following approved common names made inappropriate because of enlarged geographic distribution or host listing resulting from the Wood revision:

Sitka-spruce beetle	for D. obesus (Mannerheim)
Black Hills beetle	D. ponderosa Hopkins

The above actions are pending results of balloting for proposals received under (1) above.

New Common Name Proposals

The Committee received common name proposals for the following insects:

Spruce beetle	for Dendroctonus obesus (Mannerheim)
Mountain pine beetle	Dendroctonus ponderosae Hopkins
Fir tree borer	Semanotus litigiosus (Casey)
Incense-cedar horntail	Syntexis libocedrii Rohwer

The Committee's acceptance or rejection of the above common name proposals will be announced at the 16th Conference in Denver.

ESA Approval of Common Names of Forest Insects

The Constitution and By-Laws of the Entomological Society of America were reviewed by the Committee Chairman, and correspondence with ESA officials was conducted, relating to the organization and procedures of ESA's committee on common names. The purpose of this was to determine if present rules governing the ESA committee would allow it to give greater consideration to common name proposals submitted by one or more regional forest work conferences. Results of this survey and recommendations aimed at achieving this objective are contained in a report being prepared by the Committee for the Conference Chairman.

Respectfully submitted,

Committee on Common Names of
Western Forest Insects

Clifford E. Brown, Calgary (1965)
David Evans, Victoria (1967)
Philip C. Johnson, Missoula, Chm. (1966)
Donald A. Pierce, Albuquerque (1969)
Donald A. Schmiege, Juneau (1969)
George R. Struble, Berkeley (1966)
David L. Wood, Berkeley (1968)
J. M. Kinghorn, Victoria, ex officio

Missoula, Montana
February 19, 1965

REPORT OF ANNUAL MEETING

Committee on Common Names of Western Forest Insects
Western Forest Insect Work Conference
Denver, Colorado, March 1, 1965

The meeting was called to order at 8:00 a.m. in the Denver Hilton Hotel by Acting Committee Chairman George R. Struble. Committee members present were Brown, Pierce, Schmiege, and Wood.

The Committee approved the following actions:

1. Nomination of Robert E. Stevenson, Calgary, for consideration by the Conference Chairman as an appointee to replace Committee Member Clifford E. Brown whose term expires at the close of the 1965 Conference.

2. Affirmation of the common name proposal of "fir tree borer" for Semanotus litigiosus (Casey) and, upon approval by the Conference membership, its submission for approval to the Committee On Common Names of the Entomological Society of America.

3. Withholding of approval of the common name proposal of "incense-cedar horntail" for Syntexis libocedrii Rohwer pending clarification of some uncertainties, specifically (1) validity of the family Syntexidae (Syntectidae) (wood wasps) as distinct from the family Siricidae (horntails) and (2) use of "horntail" for a species of Syntexidae. Reference: Borrer and DeLong, "An Introduction To The Study of Insects", page 656.

The Committee proposed that the following recommendations be submitted to the Conference delegates for approval at the final business meeting of the 16th Conference on March 4:

1. That the Committee's approval of the common name proposals of "spruce beetle" and "mountain pine beetle" for Dendroctonus obesus (Mannerheim) and D. ponderosae Hopkins, respectively, be withdrawn because they are unsound without at the same time deleting former common names and because of conflicting views on their appropriateness.

2. That a moratorium be declared on any action of the Conference affecting changes in common names of the western species of the genus Dendroctonus for a five-year period from the publication of the generic revision by Stephen L. Wood, or from June 14, 1963.

3. That the Chairman of the Common Names Committee seek a statement from the Governing Board of the Entomological Society of America on rules and procedures for establishing and changing common names.

The meeting was adjourned at 10:15 p.m.

Respectfully submitted,

COMMITTEE ON COMMON NAMES OF WESTERN INSECTS

Clifford E. Brown (1965)
Philip C. Johnson, Chm. (1966)
Donald C. Schmiege (1969)
David L. Wood (1968)
David Evans (1967)
Donald A Pierce (1969)
George R. Struble, Acting Chm. (1966)
J. M. Kinghorn, ex officio (1966)

Denver, Colorado
March 1, 1965

REPORT OF TRANSLATION COMMITTEE
WESTERN FOREST INSECT WORK CONFERENCE

J. A. Chapman
D. G. Fellin
M. M. Furniss, Chairman
J. A. Schenk

Foreword

The committee was formed at the Banff meeting to investigate procedures for obtaining translations and to consider the need for maintaining a list of translations available from members of the Conference. This report fulfills these initial goals. However, should members' experience indicate need for additional action, the subject can be raised again at some future Conference.

I. RESULTS OF TRANSLATION QUESTIONNAIRE

A questionnaire was sent to 176 members of whom 97 (55 per cent) replied. Experience of those replying was: Research and Teaching (66 per cent), Survey and Control (25 per cent), and Administration (9 per cent). Answers to the questions were as follows:

QUESTION	YES %	NO %	NO ANS. %
1. Are translations needed in your work:	69	31	0
2. Is an adequate translation service available to you?	30	40	30
3. Are translations provided rapidly enough?	15	44	40
4. Is cost restrictive?	40	26	34
5. Is there a need for an annual list of translations obtained by members?	67	10	23

Many replies included comments on time required to receive translation, desirability of an annual list of translations and general comments.

Time required varied greatly; French, Spanish, and sometimes German required least time. Russian and Japanese seemed to pose the greatest problem of time and cost. While most translations seemed to have been received within a few months, some have taken from 1/2 to 1 year or longer. One request to a federal agency has not been received after two years. The U. S. Forest Service advised one member that it was unable to provide translation service in one instance.

Actual costs were seldom mentioned but one member paid $6 per hour for translations from Swedish. One said that free translation through PL 480 required up to 3 years and from 6 to 8 weeks were needed to cut through red tape for translations from other sources that cost about $20 per

1,000 words. Another member paid $60 to an individual to translate a Russian article, but the result was inadequate. Commercial sources quote $20 to $35 per thousand words, depending on language involved.

Poor quality of translations has plagued some. Twenty-four additional hours were required to edit and improve two German translations recently procured by the Intermountain Station. Such assistance is rarely available and adds to cost. The alternative of accepting translations as received and referring to them in publications may introduce errors of fact. Squeezed between these two evils, some researchers are under pressure to limit their use of translated material.

II. PROCEDURES FOR OBTAINING TRANSLATIONS

A. By Personnel of Canada Department of Forestry[1/]

Translations are provided by the Department of External Affairs, Ottawa, without cost to the researcher's project. The service is available only to Federal Government Departments. Translations are provided from any language.

To avoid duplication, the National Research Council in Ottawa maintains a card index by author of all available translations, with their price and location. This section of N.R.C. is directly linked with the Office of Technical Services in Washington. From there, the chain extends to the Association of Special Libraries in London, England, thence to the National Lending Library in Boston Spa, then the European Translation Center (E.T.S.), Delft, Holland (which is the European and Asiatic clearing house for translations in Europe and the Near East).

To determine if a requested translation exists, the Department of Forestry Library Service calls the translation center of NRC in Ottawa. If the paper were a very important one and published in one of the Slavic languages, but not recorded in the NRC file, a cable or air letter would go to the Boston Spa or the E.T.S. in Delft, dependent upon knowledge of the field in which the request was made and the type of translation being done.

Time required to translate an article varies and depends upon supply and demand. An effort is made to place legitimate rush requests on top of the pile.

A translation list for the Commonwealth Forestry Exchange is issued every six months. The Department of Forestry strives to issue a monthly accession list of translations received by its library. This list includes translations initiated by the Library and those received either on exchange or purchase from other sources.

Canadian Universities and other research organizations follow the same procedure as the Department of Forestry Library Service, i.e., they consult the NRC Master List. They usually exchange publications among themselves without charge.

1/ Based on letter dated November 10, 1964, from Miss Emily A. Keeley, Head, Library Services, Department of Forestry, Ottawa, Canada.

B. By Personnel of U. S. Forest Service

Inquiries to determine availability of existing translations should be directed to Chief, Division of Reference, National Agricultural Library, Washington, D. C., 20250. If the translation is in the NAL collection, photocopy or microfilm copies can be furnished at cost. All translations added to the collection of NAL are listed alphabetically by author in a special section of Bibliography of Agriculture. A cumulative annual list appears in each November issue.

When no translation is available and you decide to contract for translation the Library should be informed of the proposed completion date. Upon completion two copies should be forwarded to the Chief, Division of Reference, NAL; one copy for inclusion in the Library collection and one copy for the Office of Technical Services. Name of translator or contracting firm should appear on these copies.

For preclearance purposes, the following information should be supplied, if available:

1. For a book or monograph.-- Author(s), original (foreign) title, English title in parentheses, place of publication, published, publication date, number of pages, and original language.

2. For an article.-- Author(s), original (foreign) title, English title in parentheses, unabbreviated journal title in the original language, volume number, issue number in parentheses, full pagination, publication date, and original language.

The NAL does not provide translation service and does not maintain a list of sources and services.

The Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Springfield, Virginia, 22151, issues Technical Translations (Superintendent of Documents, $12 per year) in cooperation with the Special Libraries Association Translations Center located at the John Crerar Library, 35 West 33rd Street, Chicago, Illinois, 60616. Technical Translations lists translated technical literature available from the Clearinghouse, the Library of Congress, the Special Libraries Association, European Translations Center, other cooperating foreign governments, commercial translators, publishers, universities, and other sources.

The Special Libraries Association is responsible for collecting translations from non-Government sources, both domestic and foreign; the Clearinghouse for collecting translations from both U. S. and foreign government sources since 1940.

The material available from the Clearinghouse generally has been translated by other agencies of the Government and by private organizations and turned over to the Clearinghouse for reproduction and distribution. It assumes no responsibility for the accuracy of the translations.

The Clearinghouse provides reference service for the location and identification of translated materials, both completed translations and translations in process.

C. By All Other Individuals

New translations must be obtained solely from colleagues and from commercial sources. Existing translations are available through Canadian and U. S. Government sources at nominal cost.

III. DISCUSSION AND RECOMMENDATIONS

Federal entomologists in Canada seem to have adequate translation service available except sometimes for time involved. All others have no problem obtaining existing translations but are faced with the necessity to contract new translations with attendant problems of cost, time and quality.

Individuals interested in screening recent translations may refer to Technical Translations, Bibliography of Agriculture, the semi-annual translation list of the Commonwealth Forestry Exchange, and the monthly accession list of translations issued by the Canada Department of Forestry (mailed to libraries only).

Copies of all new translations should go to the appropriate government outlet in order to make them available to other members of the Work Conference. This procedure will obviate the need for the Work Conference to maintain a list of its own. In deciding to submit copies of new translations, members should not attempt to judge their worth to the membership; all translations should be submitted automatically. Translations acquired previously should be submitted in the same manner to the extent that those possessing them are able or wish to do so.

Members who experience especially good or poor results should communicate the essential information to the Chairman of the Work Conference or to the appropriate committee existent at the time.

IV. SOME SOURCES AND SERVICES

1. Kaiser, F. E. Ed. 1959. Translators and translations: Services and sources. Special Libraries Assn., Georgia Chapter, New York (31 East 10th St., New York 3, N. Y.). 60 pp.

Contains a director of translators (154 sources by languages, subjects and rates), pools of translations, and bibliographies of translations.

2. Parker, S. M., and M. Hawkins. 1959. Scientific translation. A guide to sources and services. U. S. Government Printing Office, Washington, D. C. 19 pp. Price: 15 cents.